APPENDICES

APPENDIX A

APPENDIX A

PM USA R&D 1991 Accomplishments

PM USA R&D 1991 Achievements

The 1991 achievements for PM USA R&D are listed below organized by strategic goal. These accomplishments are measured against commitments made in March, 1991, in a presentation at Innisbrook. Additional achievements covering projects not included in the original list of commitments follow.

A. Strategic Goal Number 1 - Support Operations' five year objectives in the areas of quality, cost/ productivity, capacity, and environmental compliance.

1. Quality

a. Complete development/commercialization of Osiris pack inspection system - Testing of the prototype system at the Stockton Street factory was **completed.** The commercial system is scheduled to be installed at Stockton Street in January for qualification.

b. Evaluate warming tunnels prior to casing cylinders - The Sagemuller steam tunnel was installed in the Semiworks and evaluation was **completed.** Internal testing indicated, however, that subjective parity could not be achieved with burley treated through the warming tunnel versus the standard burley treatment. The concept will be further evaluated within the context of the Improved Primary Program.

c. Initiate Adhesive Specification Program - This program has been **initiated,** and considerable progress has been made. A comprehensive status report summarizing the progress achieved in the second half of 1991 has been prepared and issued.

d. Complete KABAT program with dealers - This project has still not been completed. Two driers are scheduled to be qualified the week of January 20 at Monk. A date has not yet been set for qualification of a second dryer at Austin.

e. Develop offset printing specifications - Offset printing inks from one vendor, Hostmann-Steinberg, have essentially been qualified and are being used on an item-by-item basis. Other vendors are continuing to undergo qualification.

f. Qualify water based inks - This project has not been completed. The current status is that visits have been made to Sun Chemical and Thiele-Engdahl to discuss potential partnering arrangements to develop water based inks. A response is expected from both in early January.

g. Project FACT - This project was **completed**, and the Benedum Lounge is operating very successfully.

2. Capacity

a. Complete process design for batch NET process - The process design has been **completed**, and subjective parity for batch NET with DIET was achieved on POL.

b. Complete process and product development for cast leaf (CL) - The pilot plant has been **installed** and is **operational**. The binder and feedstock have been selected, and flavor systems are under evaluation for scale-up. Cigarettes have been produced in the Semiworks with 100% pilot plant CL and blended filler (24% CL) and are under evaluation versus production RCB to identify pilot plant process conditions needed to achieve subjective parity.

c. Qualify third party supplier for RL - Sheets were made at Schweitzer, American, and LTR for evaluation. None of these sheets achieved subjective parity with PM RL. LTR was selected as the only candidate for further development. Qualification trials have been completed at LTR with RLTC-type sheet produced from European feedstock using four different process technologies. The LTR sheet is being shipped to PM USA R&D for evaluation.

d. Qualify Venezuelan RCB - This goal was **eliminated** in that it was determined that insufficient excess RCB was available from Venezuela to make a significant impact on PM USA capacity requirements.

e. Increase throughput at BL Plant - This project has not been completed. Trials are in progress in order to achieve subjective parity of sheet produced at 350 fpm compared to the standard speed (330 fpm). Subjective evaluation is continuing for Marlboro cigarettes made with three test RCB materials produced at 350 fpm with different drying profiles.

3. **Cost/Productivity**

a. Eliminate two ET blends - BLDET was **approved** as a replacement for BBOET for Gulf Coast Country products. A decision was made to **eliminate** attempts to replace BBET in Marlboro Menthol since it was determined not to be economically viable.

b. Implement single-wrap on Superslims - **Completed.**

c. Qualify the elimination of black tow - **Completed.**

d. BL dry flavor replacement - Both the factory trial and POL testing have been **completed.** Implementation is scheduled for the first quarter of 1992.

e. Consolidation of carbon specifications - This project has not been completed and is now scheduled to be completed in the second quarter of 1993. Consolidation of two coconut carbon specifications to a single PM specification is scheduled to be completed in the second quarter of 1992.

f. MS replacement - **Completed.**

g. Bright casing consolidation - **Completed.**

h. Cambridge blend change - **Completed.**

i. Evaluate elimination of tropical filler - This project has not been completed, and is now planned to be completed in the third quarter of 1992. Cigarettes have been shipped to Singapore, and returned to R&D for evaluation. Cigarettes will be shipped to the Gulf Coast Countries in mid-January.

4. **Environmental Compliance**

a. Develop environmental testing capabilities - **Completed.**

b. Complete nicotine disposal technology for liquid column absorber - This project has not been completed, however, considerable progress has been made. Both bench and pilot scale systems have been built, and evaluation of these systems is in progress. The bench scale system will be started up in January in a cold room to verify the system under extreme conditions. The

pilot system will also be started up to obtain design data for equipment scale-up.

c. Reduce alcohol in burley top casing and evaluate casing rearrangements (Project Grain) - Work has been **completed** which demonstrates that 100% of the alcohol can be removed from burley top casing. A POL test with 52% total alcohol removal (BTC and AC) as well as 25% PG removal using humectant rearrangement is in the field.

B. Strategic Goal Number 2 - Support the growth of the domestic and international businesses short term.

1. Domestic

a. Marlboro Medium - The King Size product was **launched in June**. The 100 mm product has been developed, and POL testing is in progress.

b. Merit Ultima Line Extensions (2 mg 100, 1 mg KS) - Specifications and factory trials for this product have been **completed**. Launch is planned for Feb., 1992.

c. Benson & Hedges KS Line Extensions (Full Flavor and Lights in Regular and Menthol) - Internal testing has been completed, and consumer testing is in progress on Full Flavor Menthol. An Ad-Pack test was assembled, but it was not evaluated.

d. Parliament Lights Menthol - Specifications and initial factory trials for this product have been **completed**. The final factory trial is scheduled for the first quarter of 1992.

e. Cambridge Line Extensions (Ultra Lights KS, 2 mg 100, 1 mg KS) - The Ultra Lights product development work was **completed**; however, the product was not launched. Both the 2 mg 100 and 1mg KS were **launched in the second quarter of 1991**.

f. Initiate the Virginia KS Line Extensions - Studies have been **initiated** to determine the optimum circumference for this product.

g. Continue development of stabilized menthol family of products - Cigarettes containing three menthol-release compounds incorporated into Cast Leaf are

being evaluated to select best compound. Development of new encapsulation technology has been initiated.

2. Export

a. Japan

(1) Lark 100 FTB - **Completed.**

(2) PMSL 100 FTB - **Completed.**

(3) Improve Marlboro Manufactured Under License - Filter specifications have been adjusted to achieve target tar deliveries on Marlboro and Marlboro Lights. A collaborative study with JT is in progress.

b. Korea - Parliament Lights FTB - **Completed.**

c. Taiwan

(1) L&M Milds KS FTB - **Completed.**

(2) L&M KS FTB - **Completed.**

d. Hong Kong

(1) Battistoni KS FTB - **Completed.**

(2) PMSL KS FTB - **Completed.**

(3) Marlboro Menthol - **Completed.**

(4) Marlboro KS FTB - Conversion of Marlboro LS FTB to the 83 mm FTB product has been **completed.**

e. GCC - L&M Ultra Lights KS FTB - **Completed.**

C. **Strategic Goal Number 3 - Address consumers' desires.**

1. Continue half-nic development program - The extraction and processing parameters for a cigarette construction which will give optimum impact have been determined for half-nic. Casing evaluations are in progress.

2. Continue development of 70% reduced sidestream product with low odor - Optimization of magnesite papers has been completed, and cigarette development work is in progress. Scale-up of a second mag carbonate filler (crystalline magnesium carbonate) is in progress. Alternative flavor-release candidates for alpha-HCA are being prepared.

D. **Strategic Goal Number 5 - Develop technologies applicable to future products and processes.**

Continue program to improve ART family of products - All promising developments being incorporated into the half-nic product are also being evaluated on de-nic products. The Sensory Technology Program was initiated in order to carry out studies to develop new flavorants which will deliver impact in de-nic products.

Achievements Not Included In Original 1991 Objectives

A. Strategic Goal Number 1 - Support Operations' five year objectives in the areas of quality, cost/ productivity, capacity, and environmental compliance.

1. **Quality**

   a. Proctor and Schwartz Driers - Qualification **completed** at Stockton Street and the Manufacturing Center.

   b. Octagonal Burley Spray Cylinder - Evaluations **completed**. No further work on this project is planned.

   c. Evaporator at Park 500 - The qualification of a new low temperature evaporator has been **completed**.

   d. Semiworks Modifications - Evaluation of a modified small-scale primary has been **completed**.

2. **Capacity**

   Continuous NET - A continuous NET pilot plant was **installed** and is now operational.

3. **Cost/Productivity**

   a. New Primary Process - A New Primary Process Program was initiated with the objective of developing a flexible primary to improve productivity and reduce tobacco weight. A plan is currently being developed to incorporate elements of this concept into the Cabarrus expansion.

   b. Export Cut Filler - **Qualified** at Stockton Street.

   c. Direct Cylinder Conditioning - Primary/make-pack runs **completed** at Cabarrus, and initial consumer testing has been **completed**. Evaluation of vertical slicing method of operation is in progress.

   d. Liquid Licorice (Project Ship) - Evaluation of conversion from block to liquid licorice is in progress.

B. **Strategic Goal Number 2 - Support the growth of the domestic and international businesses short term.**

1. **Domestic**

a. Bristol Lowest - Regional launch **completed.**

b. B&H Multifilter - Replacement of plastic component with CA segment has been **implemented.**

c. 9 mg Superslims - Prototype development with both conventional and low sidestream papers is in progress.

2. **Export**

a. Japan

(1) Lark - Qualification of SCCW carbon without additives is in progress.

(2) Virginia Slims Lights - Specifications have been issued replacing MF2C carbon with Pica RC 328, and the change has been **implemented.**

b. Singapore

(1) Marlboro Menthol KS FTB - **Completed.**

(2) Marlboro KS FTB - Conversion from Marlboro LS FTB to the 83 mm FTB has been **completed.**

c. Thailand - Marlboro Regular and Menthol KS SP and Marlboro Lights KS SP were **launched** in the 3rd and 4th quarters. These are the first US products exported to Thailand.

d. Iran - Six brands **launched.**

e. PM Europe

(1) PM Extra Lights KS - Product (1 mg KS) **launched** in Italy using PCC dual filters and 10-058A paper from PM USA.

(2) BOLD KS - A 2 mg ISO tar product is in consumer testing.

f. GCC - PM 100 Menthol - **Completed.**

C. Strategic Goal Number 4 - Address External Requirements.

Continue the Development of Banded Papers - Optimization of the moving orifice device for band application is in progress. The feasibility of rotogravure printing of colloidal cellulose bands has been demonstrated.

D. Strategic Goal Number 5 - Develop technologies applicable to future products and processes.

1. Project Beta

   a. Used 100 Motorola electronic modules to optimize energy, puff parameters, and subjective response for carbon heater modules.

   b. Completed initial chemistry studies and conducted some Ames testing on Beta TPM.

   c. Developed the circuits, and built a one-half size prototype device.

   d. Initiated design for cigarette size device.

2. Tobacco Biochemistry - Carried out isolation and partial sequencing of PMT; cloned genetic material based on partial sequencing information from PMT, and initiated development of transgenic tobacco plants.

APPENDIX B

APPENDIX B

Technology Assessment

Technology Assessment

A. Introduction

A strong and continually improving technology base is an element which is essential for a business to remain competitive in today's environment. Technology grows at an ever increasing pace, and as we move continually closer to a global economy, technology can originate from any part of the world. It is no longer sufficient to be aware only of technology developed in the United States. It has been, and continues to be, a difficult assignment to manage technology at PM USA R&D. Considerable effort has been devoted to technology assessment and management during the writing of the 1992-1996 PM USA R&D Strategic Plan, and the sections below summarize this work. The first section briefly summarizes an organizational framework for categorizing key technologies which is based on the "Report of the National Critical Technologies Panel," issued in March, 1991. The second section deals with information gathered at PM USA R&D relating to those areas in which new technology is most important in order to accomplish our mission and the successful establishment of a cross-functional technology assessment committee. The third section outlines new technology achievements at PM USA R&D in 1991, while the last section discusses the leveraging of the technology base of PM Companies through technical synergy.

B. Organization of Technology Classes and Definitions

1. Introduction

Key technologies to PM USA have been divided into six categories; namely, manufacturing, materials synthesis and processing, environmental, sensory, unique smoking articles, and information and communication technologies. Each of these technologies is briefly discussed below. Specific examples of emerging technologies and strong technologies at PM USA R&D are given for each category. Emerging technologies are those not yet embodied in products, services, or processes, but with clear potential for application when fully developed. Strong technologies are those now widely used in products, services, or processes.

2. Manufacturing Technologies

Manufacturing technologies include the development, design, and integration of machines, computers, processes, and humans to cost effectively produce and manage the production of high quality cigarettes.

a. Emerging Technologies

(1) Machine Intelligence - Computer controlled equipment capable of performing a wide range of manufacturing processes (machine inspection, testing, handling, packing) with the use of sensory feedback and suitable man-machine interfaces.

(2) In Situ Process Control - The use of sensors (vision, temperature, position, etc.) and control systems coupled with expert systems to monitor and actively adjust the on-line manufacturing process.

(3) Machine Reliability - The study of machine dynamics and performance for the development of diagnostic analytical methods, design modifications, and predictive maintenance programs for the improved efficiency of manufacturing machines and operations.

(4) Computer Integrated Manufacturing (CIM) - This technology integrates process, product, and manufacturing management information into a single interactive network that greatly reduces the number of transactions necessary to produce a product.

b. Strong Technologies

(1) Vision/Optical Inspection - High speed imaging and analysis for real-time product inspection.

(2) Machine Design - Design and development of tobacco-related machines involving cigarette manufacturing and primary processing.

(3) Tobacco Processing - Equipment development for the preparation and conditioning of tobaccos for the highest quality and optimum utilization.

(4) Quality Control - An aggregate of activities (design analysis and statistical sampling with inspection for defects) designed to ensure optimum quality.

3. Materials Processing and Synthesis

Materials processing and synthesis is the preparation, forming, and shaping of raw materials into finished products through the development of new materials and novel techniques.

a. Emerging Technologies

(1) Adhesives - The development of adhesive specifications based on a thorough study of adhesive ingredients with the ultimate goal of designing new adhesives by relating adhesive performance to adhesive properties.

(2) Filter Materials - Technologies that will allow for the development of products with increased impact at low tar levels and selective control of gas phase smoke.

(3) Packaging Materials - Development of inert materials that will maintain or increase product shelf life with consideration for environmental issues.

(4) Catalysts - Development of low temperature catalysts for CO oxidation and catalysts which can be incorporated into cigarette paper which can alter the chemistry of sidestream smoke.

b. Strong Technologies

(1) Tobacco Processing - Tobacco material development for improved mechanical properties for optimum utilization and improved subjectives.

(2) Natural Binders - Improved binder systems for tobacco or sheet materials.

(3) Papers - Development of proprietary papers with improved ash appearance, puff count control and sidestream reduction; development of rational paper specifications based on cigarette specifications.

4. Environmental Technologies

Environmental technologies encompass all of the technologies required to eliminate, remediate, and process wastes for compliance with federal, state, and local regulations.

a. Emerging Technologies

(1) Emissions Reduction - Reduction in the use of raw and/or finished materials, and procedures that result in reduced emissions from the manufacturing process. Reduction of "pollution" at its source, most commonly the manufacturing process, and the implementation of improved manufacturing practices.

(2) Fumigation Methodology - Development of techniques to determine application of agents for the protection of tobacco; methods for the determination of crop protection residues on tobacco; methods for the measurement of fumigant levels in the atmosphere; and development of models to predict or verify the concentration levels for a given fumigation configuration plan.

(3) Waste Management - Management and processing of pollutants that must be discarded or warehoused in a way to minimize dangers to the environment.

(4) Biodegradable Materials - Development of materials in both the product and packaging that will degrade more rapidly in the environment than is the case for present materials.

(5) Recyclable Packaging - Development of packaging materials that are based on single materials so that they can be recycled without the need to separate components.

b. Strong Technologies

(1) Water-Based Flavor Formulations - Development of water-based flavor systems to replace ethanol-based systems.

(2) Entomology - Study of insects and their reaction to pesticides; bio-engineering techniques to control undesirable infestations.

(3) Microbiology - Minimization of biological activity in tobacco sheet products and waste water through physical separation, electrical component separation, and microbial transformation.

5. Sensory Technology

Sensory technology is the development of a fundamental understanding of those physical, chemical, and biological system interactions that result in a subjective response to a product.

a. Emerging Technologies

(1) Biochemical Techniques Related to Sensory Response - Development of a quantitative description of the receptor-substrate interactions responsible for subjective response to cigarettes.

(2) Flavor Encapsulation - Release systems based on incorporation of flavor compounds in a thermally labile encapsulant.

b. Strong Technologies

(1) Filtration Mechanisms - Physical or chemical processes to remove vapor and/or particulate components from smoke or air.

(2) Flavor Release - Preparation of compounds incorporating flavors which will release the desired flavors on heating.

(3) Flavor Formulation - Formulation of mixtures of natural or synthetic compounds to produce desired subjective responses.

6. Unique Smoking Article Technology

Unique smoking article technology encompasses those areas directed toward the development, design, and manufacture of unique smoking products.

a. Emerging Technologies

(1) Energy Sources - The development of small, powerful batteries to power unique smoking articles.

(2) Aerosols - Technologies involving the development of techniques to control aerosol generation and aerosol physical properties.

(3) Microelectronics - The development and design of integrated circuit chips that have improved performance and resistance to corrosion and heat.

(4) High Speed Machine Design - Development of "intelligent" machinery capable of assembling and inspecting a mechanical cigarette type device at speeds that will make a unique smoking article a viable business venture.

(5) Specialty Materials - Development of insulating and conductive materials to be used for the design of semiconductors and cartridges.

(6) Microfabrication - Technology which involves the fabrication and manipulation of materials and objects on a microscopic level. This technology includes etching, lithography, and epitaxil growth and deposition.

b. Strong Technologies

(1) Combustion/Heat Transfer - Physical mechanisms, materials, and chemical/thermodynamic properties that control heat transfer.

(2) Chemical Energy Sources - Technologies associated with the development of high energy heat sources for unique smoking articles.

7. Information and Communications

Information and communications technologies are those enabling technologies that affect our approach to data storage and retrieval, simulation, information dissemination, and computing.

a. Emerging Technologies

(1) Computer Simulation and Modeling - The use of computers to replicate, predict, and simulate the behavior of a physical system.

(2) Signal Processing - Consists of signal conditioning (correction of electrical impulses by the elimination of noise) and signal processing (evaluation of corrected signal for decision making or display). The recent development of chip level sensors has integrated the signal processing into the sensor itself.

(3) Measuring and Sensing - Development of techniques using sensors to measure and identify environmental variables (voltage, position, temperature, pressure, physical state, concentration of specified compounds).

b. Strong Technologies

(1) Math Modeling - Modeling using principles of physics, thermodynamics, chemistry, and mathematics to test systems prior to design and manufacture. Computational fluid dynamics, finite element modeling, and regression analysis are a few examples in use.

(2) Consumer Behavior Prediction - Psychophysical models of subjective response; theories of market dynamics; and consumer testing methods.

(3) Neutron Radiography - Thermal neutron imaging of cigarettes and smoke for product and combustion studies.

(4) Data Storage and Peripherals - Data storage conversion of magnetic devices to optical compact disk read-only-memory (CD-ROM), write-once read-only-memory (WORM), and other rewritable storage media for computers. In addition, the development of technologies that transform current input/output hardware (keyboards, mice, light pins, printers) to voice recognition systems, 3D imaging devices, or music synthesizers. Storage and peripheral technologies will be the limiting factor in our ability to model, archive information, and interact with computers.

C. PM USA Technology Management

In order to further refine the technology needs of PM USA considerable effort was devoted to working with both the R&D senior technical staff and R&D management in order to identify technologies considered to be essential to the accomplishment of current R&D

programs. Technologies identified include, in order of importance as determined by the number of individuals identifying a particular technology, the following:

1. Environmental issues/control of emissions
2. Mathematical modelling
3. Sensory technology (chemical senses)
4. Vision and/or optical systems
5. In situ process control
6. Manufacturing technology
7. Information management
8. Technology required for Project Beta
9. Packaging technology
10. Robotics
11. Selective filtration
12. Cigarette burn rate control

There are few surprises on this list, and current R&D projects already incorporate many of these technologies. Knowing what technologies we require, however, leaves several important questions unanswered, such as: Is the in-house development of these technologies sufficient to meet R&D needs? Is there new technology in these areas being developed outside which we need to bring into R&D? If additional resources need to be devoted to any of the above technologies, how are priorities established?

It is actually the last of these three questions which needs to be addressed first, and in order to appropriately prioritize PM USA's technology requirements, it is essential to involve the entire Operations Department. As a consequence, a cross-functional Operations Technology Assessment Committee was formed in late 1992. The mission of this Committee is to:

1. Identify areas of improvement within the respective functional areas that impact the product.

2. Categorize the areas for improvement utilizing the framework discussed in Section B above.

3. Develop a prioritized list of technologies to pursue.

4. Present recommendations to management.

5. Incorporate technology needs into R&D Strategic Plan and the PM USA Operations Plan.

6. Monitor current initiatives.

Technology needs will be ranked according to a number of key qualities possessed by the project(s) requiring the technologies. These qualities include merit of the project, durability of competitive advantage, cost of research, cost to implement, and product horizon. The membership of the Committee is listed in Table VII (p. 87) in the PM USA 1992-1996 R&D Strategic Plan.

D. PM USA R&D 1991 Technology Achievements

1. Domestic and Export Product Development

   a. Merit Ultima and PM Extra Lights - Italy

      (1) Paper core concentric dual filter
      (2) High chalk paper for puff count control

   b. Lark combining wrap

2. Paper Technology

   a. Single wrap for Superslims
   b. Proprietary Low Sidestream inorganic fillers prepared using sol-gel technology

3. Beta

   a. Phase I electronic devices
   b. Half-size devices
   c. Subjective program - optimization of materials, components, and energy input

4. NET

   a. Batch process
   b. Vapor phase reordering
   c. Continuous NET pilot plant

5. New Primary Processing - Direct cylinder conditioning

6. Cast Leaf

   a. Cast Leaf pilot plant
   b. New Blended Leaf (NBL)
   c. Cast Leaf sheet with guar gum

7. Project Tomorrow

   a. Computer program for correlation of mass burn rate with cigarette construction parameters
   b. Printing of colloidal cellulose bands with rotogravure press
   c. Technology to determine dynamic mass burn rates

8. Environmental Support

   a. Project Grain
   b. Humectant reordering

9. Optical Processing

   a. Osiris pack inspection technology
   b. Web inspection device

E. Leveraging PM Companies' Technology Base Through Technical Synergy

The PM Companies Technical Synergy Group was initiated in 1988 shortly after the purchase of General Foods. The mission of this group was to increase effectiveness and reduce costs of R&D throughout PM Companies wherever possible through well-designed interactions among all of the technical centers. The Committee was composed of representatives from each PM Company laboratory, and the group was expanded when Kraft was added to the company. Current membership consists of Charlie Adamo from KGF International; Manuel Bourlas from PM International; Charlie Cante from GF USA; Jim Charles and Ken Houghton from PM USA; Rick Guardia from KGF Scientific Relations; Ron Harris from Kraft USA; Darrell Medcalf from KGF Technology; Art Rehberger and Ken Wendt from Miller Brewing; Paul Roehrig from Oscar Mayer, and Danny Strickland from KGF FPG. Chairman of the Committee is Bob McVicker, KGF.

There have been a significant number of technical synergy interactions involving PM USA during 1991. Formal interactions include a two-day symposium in the fall covering the topic, "R&D in the 90's and Beyond;" one "mini symposium" in August dealing with analytical chemistry; and three meetings of the PM Companies Technical Synergy Committee. Informal interactions also took place. Individuals from Jacobs Suchard and KGF Coffee visited PM USA R&D and took part in a number of technical discussions. Particular interest was shown in the Paper Technology and Sensory Technology Programs. A presentation was made at Kraft USA by an individual from PM USA dealing with the application of neural networks in consumer testing studies; and a talk was given at PM USA by an individual at Kraft USA on product testing strategies.

A number of cross-laboratory projects were completed in 1991. Pilot studies were carried out at PM USA investigating the feasibility of extracting fat with supercritical carbon dioxide from peanuts, chocolate and coconut. Promising results were obtained, and Kraft personnel plan to continue the work with peanuts in their own facilities. Analysis of vanillin obtained by microbial techniques at GF USA was conducted to determine both the level and identity of possible impurities using the tandem mass spectrometer at PM USA. Data were obtained at the GF USA environmental laboratory for a PM USA study on OV changes in cigarettes exported to certain markets. Work was also carried out by the KGF USA binder group in collaboration with PM USA personnel for the Cast Leaf Program.

Other interactions include a visiting scientist from Miller Brewing who spent all of 1991 working in the Biochemical Research Division; information was submitted to Miller Brewing dealing with the PM USA R&D Strategic Planning Process and the Technical Ladder; and both Kraft USA and GF USA Technical Information personnel interacted with the PM USA CI Task Force. The two last interactions to be discussed are perhaps the two most far-reaching examples. A crop protection agent data base was established in conjunction with Shook, Hardy, and Bacon. This data base is being administered by the Technical Synergy Committee, and serves all of PM Companies. Lastly, the PM USA patent data base was completed, and it will be incorporated into a PM Companies patent data base.

The Technical Synergy Committee will continue to be an integral part of PM Companies technology management strategies in 1992. A meeting of the Committee is planned for February, 1992, and at least five major topics will be on the agenda. These topics are: 1) how better to develop PM Companies' technical and management talent within technology functions worldwide; 2) techniques for increasing the ease and effectiveness of technology and idea transfer across company lines: 3) the needs and development of long-term research programs; 4) the advisability of forming macro strategic alliances; and 5) determining how to administratively handle joint programs. In addition, one symposium is planned for 1992, to be held in the fall, with the most likely subject being the environment and related issue.

A great deal has been done in the area of technical synergy since the initiation of the Technical Synergy Committee. However, a great deal more can be done. There are clearly a number of barriers to obtaining the maximal benefit from technical synergy within PM Companies. It should be an objective of the PM USA Technology Assessment function to identify these barriers so that action can be taken to eliminate them.

1991 And 1992
PM USA R&D Collaborative Research Programs

Program Description	Location	Budgeted Amount ($000)	
		1991	1992
Heat Sources/Combustion Modeling/ Sigma	NY Polytechnic	94.6	-
Project Beta	Motorola	695.7	-
Project Beta	-	-	1,126.2
Preparation of Nicotine Antibody	Litron Labs/Hazleton	8.4	1.0
Mycoplasma Testing	ATCC	1.5	-
DNA Synthesis	MCV	5.2	-
2D SDS-PAGE Separations	Kendrik Labs	4.2	-
Development of Regulatory Data Base	-	125.0	130.0
Protein Sequencing/TSNA	Univ. of Wisconsin	4.7	10.4
Neutron Radiography	University of Va.	174.3	171.3
Inorganic Investigations/Paper Technology	NY Polytechnic	141.5	140.0
Low Level Counting	Battelle NW	21.0	15.6
Large Scale Inorganic Synthesis/ Paper Technology	Various	41.9	51.9
Inorganic Investigations/Paper Technology	VPI	21.0	-

1991 And 1992
PM USA R&D Collaborative Research Programs
(Continued)

Program Description	Location	Budgeted Amount ($000)	
		1991	1992
Paper Technology	Univ. of Wisconsin	52.5	-
Paper Technology	Univ. of Maine	60.0	64.4
Paper Technology	SERI	-	78.6
Custom Synthesis	VCU/Aldrich/Lee Labs	18.0	-
Cluster Formation (Aerosols)	Colorado State	129.9	-
Oxidation Catalysts/Selective Filtration	Seton Hall Univ.	116.3	161.9
Synthesis of Stable Menthol	-	-	51.9
Optical Processing	Carnegie-Mellon	75.5	-
Simulation of Liquids & Aerosols/ART	VPI	57.7	-
Single Particle Aerosol Chemistry	Univ. of Washington	41.9	-
Thermodynamic Properties of Supercritical Fluids	Georgia Tech.	13.1	-
Project ART Water Column	University of Texas	26.2	-
Aerosol Research	VCU	-	115.3
Project Tomorrow and Process Applications	Creare.x	-	28.1

1991 And 1992
PM USA R&D Collaborative Research Programs
(Continued)

Program Description	Location	Budgeted Amount ($000)	
		1991	**1992**
RL Rebuild	-	-	31.1
Environmental Work	Various	-	41.5
Project NET	Various	63.1	-
Engineering Design/Water Treatment	Various	78.8	-
Engineering Services	Nolen, Friska, Brooks	37.0	32.6
Engineering Services	Quantum Tech.	-	7.9
Emergency Response Team	FDM Safety Services	24.1	26.0
Contract Programming	McKinney & Assoc.	-	10.4
Contract Programming	Various	8.2	12.5
Total		**2,141.3**	**2,308.6**

1991 And 1992
Research Programs - Cosmic/Sensory Research

Professional Services	**Budgeted Amount ($000)**	
	1991	**1992**
Dr. Mangin	106.0	124.6
Dr. Eysenck	106.0	-
Dr. Harley	42.1	20.8
Dr. Ashby/Dr. Nosofsky	36.0	-
Dr. O'Mahony	36.0	-
Total	**326.1**	**145.4**

1991 And 1992
Research Programs - Cosmic/Sensory Research

Consulting	**Budgeted Amount ($000)**	
	1991	**1992**
Dr. Musto	-	1.0
Dr. Eysenck	4.2	4.2
Dr. Harley	8.4	-
Dr. Mangan	5.2	-
Dr. Warburton	6.5	4.2
Dr. Ashby	1.5	-
Dr. O'Mahony	1.5	-
Dr. Bockenhott	0.8	-
Total	**28.1**	**9.4**

1991 And 1992
PM USA R&D Consulting Relationships

Program Description	Consultant	Budgeted Amount ($000)	
		1991	1992
ANSI	R. Dawson	4.2	-
Regulatory Agencies (Ingredients)	J. Stoffberg	2.1	0.7
Chemistry and Biochemistry	A. Wolf	12.5	12.5
Analytical Chemistry	F. Hawkridge	1.6	-
Heavy Metals in Packaging	-	5.3	-
Tissue Culture	F. Wu	1.0	2.1
Protein Sequencing	S. Jensen	1.0	-
Analysis Development	G. Berntson	1.6	2.1
Molecular Genetics	M. Conkling	2.1	4.2
Electrophysiology	G. Kobal	2.6	-
Monoclonal Antibody Production	A. Tometsko	1.0	-
Biosensors/Antibodies	G. Guilbault	2.0	1.2
Cigarette Paper Properties	C. Mattina	6.3	-
Organic Chemistry	L. Harwood	6.3	-
Aerosol Formation	P. Byron	4.2	5.2
Elisa and Antibody Studies	M. Hein	-	2.1

1991 And 1992
PM USA R&D Consulting Relationships
(Continued)

Program Description	Consultant	Budgeted Amount ($000)	
		1991	1992
Synthetic Scale Up	P. Harris	-	2.6
Surface Chemistry	G. Somorjai	4.2	-
Inorganic Chemistry	D. Schleich	-	7.2
Optical Components	A. Vanderlugt	3.1	-
Electrostatics, Fluid Jets, Robotics	-	4.2	-
Processing Systems	T. Fazzina	26.3	27.0
Separator Design	F. Zenz	15.8	-
Process Modeling	-	-	20.8
Continuous Process/NET	M. W. Kellogg	31.5	-
Primary Equipment Design	-	-	26.0
Flavor Separation	Various	10.5	-
Nicotine Disposal	Various	10.5	-
Computational Fluid Dynamics	S. Patankar	-	7.5
Flavor Development	L. Davis	20.8	10.3
Total		**180.7**	**131.5**

APPENDIX C

APPENDIX C

PM Europe R&D Three-Year Plan

R&D THREE YEAR PLAN

1992 - 1994

SEPTEMBER 13, 1991

EXECUTIVE SUMMARY

The PM Europe R&D Three Year Plan 1992-1994 has been developed with the purpose of selecting those programs and priorities which will allow R&D to contribute in the most constructive fashion to the achievement of the goals of PM International during this Plan period. PMI's objectives for the 1992-1994 Plan period are as follows:

* **A minimum 6% annual growth rate in total unit volume;**
* **Market share growth in all markets;**
* **A minimum 20% annual growth in total Income from Operations and Net Income;**
* **To further develop PM's international trademarks with the aim of making them global brands;**
* **To be the low-cost producer within the industry without sacrificing quality leadership, while improving the Return on Management Investment;**
* **To continue to maintain tight control of headcount in the Regional offices.**

A review was made of our current status and the international business environment. This included consideration of the changing regulatory situations in the EEC Region and the rapid growth being experienced in the EEMA Region. As a result of this analysis the following five strategic goals were identified:

1. **Support Operations' three year objectives in the areas of quality, cost, productivity and capacity.**
2. **Support the growth of the EEC and EEMA Region businesses in the short term.**
3. **Develop new and innovative products which address consumers' desires in the long term.**
4. **Identify, evaluate and develop technologies applicable to future products and processes.**
5. **Address external issues and requirements.**

Nine major programs were then identified which would support and further the realization of these strategic goals, as shown in the outline below. In several cases programs are listed as contributory to more than one of these goals. It should be noted that where programs exist in PM USA R&D which potentially impact on International objectives, PM Europe R&D programs have been established to be supportive and complementary. The strategic goals and the programs of R&D are projected to be as follows:

1. **Quality, cost, productivity and capacity.**
   - Operations Support
   - Reconstituted Tobacco
   - Expanded Tobacco
   - Product Development

2. **Growth of businesses in the short term.**
   - Product Development
   - Expanded Tobacco

3. **Innovative products in the long term.**
   - Product Development
   - New Product Technology
   - Product Evaluation/Consumer Desires

4. **Technologies for future products/processes.**
   - New Process Technology
   - New Product Technology
   - Product Development

5. **External issues and requirements.**
   - Environmental Tobacco Smoke
   - Pesticides, Ingredients & The Environment
   - Product Development

In the course of the analysis a number of issues were also identified which, without proper attention, could become serious obstacles to our continued efficient operation. These are issues which are persistent and not quickly resolvable, and the formulation of contingency plans to deal with them will be initiated.

These issues are:

1. The impact on resource allocation of potential headcount restrictions and space limitations.

2. Explosive future growth within the EEMA Region which may require unanticipated support resources;

3. An unknown regulatory environment across both Regions with respect to crop protection agents and ingredients, and to packaging from the standpoint of chemical additives and waste disposal;

4. A serious shortage in the pool of qualified technical talent available for recruitment;

5. The increasing need to provide more rapid training and development of a technical leadership base for the future through cross-training and management development.

The program objectives and the strategies for achieving them are outlined in the following pages for each of the nine major programs. In the Operations Support program will be found a collection of objectives since the program is quite diverse in scope, encompassing individual and group efforts of the R&D departments. Although the remaining programs have each been developed about a single objective, they also reflect the interdepartmental efforts in the strategies. For reference purposes, highlights of our present position in many of the program areas are appended to this document.

R&D PLAN

Program: **OPERATIONS SUPPORT**

Issue: How do we enhance the quality of our products so as to eliminate, to the extent possible, manufacturing defects?

Business Risk: Failure to minimize visual quality defects and spoilage could result in consumer switching to competitor products.

Objective: Improve quality of PM products through improvement of materials and methods.

Strategies: Implement a total quality management program in all PM Europe factories, with a first goal of improving the quality assurance systems so as to be in compliance with ISO recommendations, and to have all factories certified according to ISO 9002.

Develop, together with Marketing, a program to address the consumers perception of quality and use it, along with consumer complaint data, to establish quality improvement programs.

Continue the qualification of new plug wrap/tipping paper combinations which improve machinability and will reduce consumer complaints related to filter attachment.

Develop, in conjunction with our suppliers, new cigarette papers with improved machinability on higher speed makers.

Assist PM Europe factories to improve filter consistency and machine efficiency while reducing material waste and manufacturing costs.

Critically evaluate the use of near infrared (NIR) methods as a production QA tool for the indication of any corrective measures necessary prior to the application of flavors and casings.

Assist in the evaluation and installation of foreign matter detection and removal systems.

Maintain state-of-the-art methods to measure temperature and humidity during tobacco storage and processing, and attempt to establish guidelines for the minimal impact of microbiological activity on subjective quality.

Issue:	How do we standardize our Quality Assurance functions at all locations where PM products are produced ?
Business Risk:	Failure to provide QA technical support to all sites will result in varying degrees of quality for the same brands in different markets.
Objective:	Provide and distribute quality assurance know-how throughout the EEC and EEMA Regions.
Strategies:	Provide PM Europe affiliates and licensees with the technical support to improve the visual quality of their products.
	Provide all PM Europe manufacturing sites with technical support in the areas of QA systems, organization, methods, equipment and procedures to meet PM quality standards.
	Continue to implement and monitor the PM Infestation Control program in all licensee and affiliate locations.
	Train all PM Europe tobacco suppliers on proper fumigation practices according to PM standard operating procedures for phosphine fumigations.
	Monitor official testing laboratories and ensure that the testing of PM products is properly conducted.
	Implement general quality assurance training programs for licensees and contract manufacturers.

Issue:	How do we ensure the consistent quality of our products which are produced in numerous factories ?
Business Risk:	Failure to ensure consistency in product quality could erode the consumer image of our products.
Objective:	Assure that quality objectives and quality perception, and the measurement and interpretation of QA data, are standardized throughout PM Europe.
Strategies:	Finalize new sampling and acceptance procedures for ingredients, filter additives, adhesives and inks.
	Complete the revision of packaging material specifications.
	Establish general specifications for filter tows.
	Continue the efforts to introduce concentrated base flavors in Marlboro production in order to realize cost savings.
	Continue to approach standardization of QA methods and procedures through expert working groups in the areas of incoming materials, primary QA, secondary QA, smoking laboratory and panels.
	Improve the consistency of European B-panels through comparative testing.

Issue:	How do we ensure that all of our products conform to PM quality standards and meet regulatory requirements ?
Business Risk:	Failure to adequately control the quality of non-tobacco materials, tobaccos and products could result in losses of sales, losses during storage, and possible penalties for mislabeling.
Objective:	Assure that all PM products conform to PM quality standards and regulatory requirements.
Strategies:	Introduce the new visual quality audit, prepared in collaboration with PM USA, in all affiliates and licensees.
	Establish a yearly vendor rating based on delivered quality, purchasing aspects and vendor audits.
	Audit PM and competitor products in the Regions in order to monitor trends and provide data to support new product development and introductions.
	Monitor PM products in the Regions in order to assure that they will comply with PM specifications.
	Review the CIR reporting system to see if strategic information can be condensed and highlighted for use by R&D, Leaf, Marketing, and management.
	Monitor sufficient numbers of tobacco lots to ensure that all PM Europe blends will result in cigarettes meeting the tar/nicotine delivery specifications.
	Introduce the new ISO norms for cigarette smoking analysis in the three European PM smoking laboratories.
	Coordinate a program with Engineering and the factories to identify and implement improvements in procedures for the control and measurement of filter weight, plasticizer application level and firmness.

Issue:	How does PM Europe meet its volume projections with the limited production capacity available ?
Business Risk:	Failure to address this issue could result in severe limits in our ability to meet market demands for our products.
Objective:	Implement a program which adequately addresses capacity requirements.
Strategies:	Assist in the selection, qualification and evaluation programs for new primary equipment and in the definition of process parameters.
	Assist in the design, start-up and qualification of primary extensions and new primaries.
	Evaluate the total blend sieving and cutter bypass in the PM Australia primary and develop recommendations for Europe.
	Perform project reviews, establish recommendations for process improvements, and provide assistance and consulting service to licensees.

Issue:	How do we ensure consistent and optimal quality of our blend component processing and finished cut filler ?
Business Risk:	Failure to standardize our tobacco feedstocks could result in undesired variations in our subjective product quality.
Objective:	Develop and implement programs focused on standardization of primary processes and tobacco materials.
Strategies:	Maintain and update the PM Europe Primary Information manual, complete the factory comparisons and develop general primary guidelines.
	Evaluate and make recommendations to further improve specific process unit operations of the affiliates and licensees.
	Standardize, to the maximum extent possible, processes and unit operations when qualifying new or modified equipment.
	Coordinate the utilization of good manufacturing practices (GMP) for PM Europe.
	Identify the impact of primary processing changes on product quality through physical analysis of tobacco (filling power, shred size).

Program:	RECONSTITUTED TOBACCO
Issue:	How do we ensure sufficient and interchangeable quantities of sheet materials for our future needs ?
Business Risk:	Failure to address this issue could result in undesired changes in subjective product quality and lack of product standardization.
Objective:	Define, in collaboration with PM Europe Leaf and PM USA, our company's worldwide sheet requirements versus capacities and develop alternate sheet products.
Strategies:	Optimize the future utilization of OTMs with respect to all existing and new reconstitution processes.
	Assist in the PM USA development of the cast leaf process and qualify European feedstock for this process.
	Provide support for a pre-engineering study concerning the potential new BL facility in Europe (Greenfield study).
	Evaluate and qualify, in conjunction with PM USA and PM Europe Leaf Departments, alternate sheet materials to those made in PM USA.
	Assist Bandtabak Malchin (BTM) in their sheet quality improvement program.
	Complete the humectant level standardization program for PM Europe.

Program: **EXPANDED TOBACCO**

Issue: How do we ensure sufficient and interchangeable quantities of expanded tobacco for our future needs while improving the safety of the operations ?

Business Risk: Failure to address this issue could result in undesired changes in subjective product quality, lack of product standardization, and substandard processing environments.

Objective: Implement process and product quality improvements, standardization and adequate safety procedures in the four European ET facilities.

Strategies: Complete the ET Pan Europe report, and the ET section of the Primary Information manual, and implement the follow-up for plant optimization and standardization.

Establish and implement ET product specifications and process targets.

Qualify and evaluate equipment and blends, including the new ET feedstock processing line at FTR in Onnens and the new ET installation at BOZ.

Assist the facilities in the implementation of process improvements and blend modifications.

Develop and implement the NET evaluation and qualification program for PM Europe.

Assist in the follow-up to the Kellogg hazard review, the metallurgical investigation, and in general safety matters.

Program: **PRODUCT DEVELOPMENT**

Issue: How do we reposition our current brands and introduce brand extensions and new brands to assure coverage of the important market segments ?

Business Risk: Failure to correctly position our brand families could result in missed market opportunities and loss of advantage from our current competitive position.

Objective: Modify existing products and develop new products to meet Marketing, productivity, standardization and/or regulatory requirements.

Strategies: Support actively all programs aimed at monitoring consumer perceived product performance of our key brand families and initiate, as needed, product modification programs in order to ensure our competitive advantage in the market-place.

Ensure product standardization within brand families and clear differentiation of product performance between brand families based on business objectives.

Improve and maintain our computerized project management system in order to optimize the speed and flexibility of the product development process.

Develop and apply a screening system that can be used to select the most attractive opportunities from our inventory of all new and innovative product ideas generated within the company.

Develop and implement a program to reduce tar deliveries of all of our brands (if needed) to ensure compliance with the 1993 EEC tar ceiling regulations.

Develop a long-term plan for the further reduction of the tar deliveries of our brands so as to comply with the 1998 EEC tar ceiling regulations, including the evaluation of emerging technologies for low tar/high taste.

Implement programs aimed at substituting important product components such as:

- DIET by NET
- RL-TC ex PM USA by RL ex LTR
- MPEG by Triacetin
- Licorice by Flavor Concentrate

Program: **NEW PRODUCT TECHNOLOGY**

Issue: How do we identify and evaluate new product technology which will allow us to be a leader in innovative product concepts, and will enable us to respond to competitive challenges ?

Business Risk: Failure to maintain capabilities for innovative product introductions could result in the inability to participate in new and unique market opportunities.

Objective: Increase the effectiveness in technology management in order to improve product innovation, and create new and innovative ideas/concepts for the cigarette market.

Strategies: Monitor technologies developed within and outside of the corporation on a worldwide basis to identify potential areas of application and maintain a technology "storehouse".

Strengthen our know-how in the area of technology-product relationships in order to:

a) Improve our mathematical prediction models to enable rapid achievement of product objectives for mainstream and sidestream smoke deliveries;

b) Select and assess key technologies for the development of innovative products.

Develop specifically the following selected technologies to the stage of industrial application:

- Total Blend Expansion
- Tobacco Sheet Filter
- CA-Web Filter
- Tobacco Sheet Cigarette Wrapper
- Dual Cigarette Wrapper
- Tobacco Extract Flavors
- Concentric Tobacco Rod

Evaluate new filter construction concepts to determine whether smoke exit flow patterns can be used as a tool to influence perceived subjective quality.

Evaluate new filter construction concepts which might provide enhanced control of gas phase mainstream smoke chemistry.

Assess technologies available for the enzymatic removal of specific tobacco components which might lead to a more desirable mainstream and sidestream smoke.

Determine the effect of cigarette construction parameters and filler additives on total sidestream smoke yield.

Identify naturally occurring materials in certain tobaccos which have preservative or pesticidal properties and might be acceptable alternatives to currently used control agents.

Explore modern genetic engineering techniques which have the potential to impart preservative or pesticidal properties to tobacco without leaving undesirable residues.

Program: **PRODUCT EVALUATION/CONSUMER DESIRES**

Issue: How do we build our knowledge of consumer desires to enable us to develop market-led products ?

Business Risk: Failure to understand performance-driven market dynamics could result in loss of market opportunities and loss of existing market shares to the competition.

Objective: Develop our understanding of consumer perceived product performance.

Strategies: Improve and maintain our internal descriptive panel in order to build a consistent data base on subjective product attributes of competitive products as well as of cigarette prototypes.

Improve and maintain, in collaboration with Market Research, the computerized model in which market dynamics are correlated with measurable and subjective product attributes.

Monitor the evolution of the key competitive products by making optimum use of our current cigarette information activities and ensure rapid awareness on competitors new product introductions.

Advise Market Research on qualitative and quantitative design and content of consumer test questionnaires in order to improve our interpretation and understanding of consumer test results.

Program: **NEW PROCESS TECHNOLOGY**

Issue: How do we identify and evaluate new process technology which will allow us to maintain product quality leadership in the industry ?

Business Risk: Failure to update our process technology could result in erosion of competitive quality and in lack of flexibility and interchangeability in component utilization.

Objective: Develop, evaluate and implement new processing technologies for potential application in PM facilities.

Strategies: Qualify and evaluate the direct cylinder conditioning unit including casing application in the new ET feedstock processing line at FTR in Onnens.

Implement the evaluation program of the new Hauni HT tunnel prior to the dryer in the Miniprimary.

Complete the evaluation of the program for cut filler recovery from winnowers.

Monitor and assist in the New Primary Process program initiated in PM USA.

Identify technologies in industries similar to ours and intensify contacts with equipment suppliers to keep abreast of new developments.

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Program: **ENVIRONMENTAL TOBACCO SMOKE**

Issue: How do we confront attacks on PM and our industry based on presumed health risks of environmental tobacco smoke ?

Business Risk: Failure to maintain technological awareness could result in restrictive laws against smoking at work and in public places, and in increased risk of product liability action.

Objective: Assess the impact of environmental tobacco smoke (ETS) on indoor air quality.

Strategies: Conduct investigations on the potential formation of undesirable components in aging ETS and assess how they might be controlled.

Investigate the influence of household furnishings on the aging and accumulation of ETS.

Participate in industry programs to develop and recommend analytical methodology for use by industry and government.

Develop and use portable monitoring equipment to evaluate indoor air quality in public structures and transportation.

Evaluate methods proposed in the literature for chemical markers intended to indicate exposure to environmental tobacco smoke.

Assure that sidestream yields of PM products are in compliance with future internal guidelines and provide market-place surveys.

Program: **PESTICIDES, INGREDIENTS & THE ENVIRONMENT**

Issue: How do we anticipate and satisfy all the regulatory requirements arising from environmental pressures on our products ?

Business Risk: Failure to respond could result in nonshipment of finished products, product recall from the market-place, loss of market shares, and civil and criminal liability for local operations management.

Objective: Ensure that blend components, nontobacco materials, finished products and packaging comply with existing and future legal requirements in both the EEC and EEMA Regions.

Strategies: Monitor pesticide residues on incoming tobacco lots, finished products and potential leaf purchases with a frequency based on legal requirements and sound statistical practices.

Monitor ingredient levels in cigarette, packaging and manufacturing materials either currently being used or being evaluated for qualification to assure compliance with legal requirements in the PM Europe Regions.

Extend analytical capabilities for pesticides and ingredients for which legislation is being proposed or which are considered undesirable in, or in contact with, our products.

Develop rapid screening methods for pesticides which will allow a significant reduction in workload while maintaining a high level of reliability.

Establish a database for analytical methods and reported results, possibly in conjunction with other PM companies, which would allow systematic reevaluation of the monitoring levels which are necessary to maintain due diligence.

Identify areas of processing and packaging which may pose environmental impact problems in the future, and initiate plans for technological solutions.

Identify regulatory issues of corporate concern in the EEC and EEMA Regions, advise management on their technical and legal ramifications, and represent the industry's interests through interactive programs with scientific and norm associations.

Contribute, through contact with suppliers and governmental authorities, to the registration of PM recommended infestation control products.

Develop, together with suppliers, new adhesives for cigarettes and packaging materials which are based on naturally occurring substances.

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R&D PRESENT POSITION

Program: **OPERATIONS SUPPORT**

Objective: Improve quality of PM products through improvement of materials and methods.

Highlights: A standard format is being developed for the reporting of consumer complaints.

New porous plug wraps have been developed jointly with Schoeller & Hoesch and Dexter, and testing for improved machinability will be completed in early 1992.

Machinability improvements for cigarette papers were achieved in a joint effort with Wattens and de Mauduit.

A near infrared (NIR) method has been developed for the control of eight flavors and casings prior to application, and procedures to enable use of the method by QA are now being established.

A ripper screening cost study was completed.

A comparison of packing density and OV between machine threshed and hand stripped tobacco was made for Malawi flue-cured and burley.

The first foreign material detection and removal system is being placed in PMG Berlin.

The microbiological and chemical states of burley tobacco, before and after drying treatment, are currently under evaluation.

It was shown that dipicolinic acid, which is released subsequent to the germination of Bacillus spores on tobacco, can be a major source of off-taste, and an analytical method for its detection on tobacco was developed.

Objective: Provide and distribute quality assurance know-how throughout the EEC and EEMA Regions.

Highlights: Technical assistance in the areas of quality systems (organization) and visual quality was provided, and/or audits of quality assurance functions were performed in Italy, Hungary, Poland, Turkey and South America.

The PM Infestation Control program was reviewed on site with all affiliates and 15 licensees.

Training on the PM standard operating procedures for fumigations was given to 35 leaf suppliers.

Through collaborative studies it was assured that governmental laboratories correctly tested and accepted PM products in different markets.

A general presentation on quality assurance was prepared, covering the PM quality philosophy, the quality assurance organization and the tasks of the individual departments.

A training course, "Statistics in QA Laboratories," was organized for all PME affiliates.

Objective: Assure that quality objectives and quality perception, and the measurement and interpretation of QA data, are standardized throughout PM Europe.

Highlights: An incoming inspection procedure for tobacco ingredients and filter additives was established and is currently under review in the Legal Department.

Methods for the analysis of powdered ingredients have been elaborated, based on time-saving near infrared technology.

A program for the routine analysis of solvents in printed materials has been established and implemented.

Industrial trials with concentrated base flavors (Marlboro), aiming at cost reductions and standardization with PM-USA, have been carried out in BOZ, Berlin and FTR.

Further standardization of QA methodology and procedures was achieved through the established working groups in the areas of incoming inspection, primary QA, secondary QA, smoking laboratory and panels.

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A study addressing the feasibility of a single smoking laboratory for PM Europe was completed.

The DDD (determination of differences) method used by all the European B-panels was reviewed and the results of inter-affiliate collaborative tests improved accordingly.

A B-panel was set up in Modena.

Objective: Assure that all PM products conform to PM quality standards and regulatory requirements.

Highlights: The new visual quality audit system was introduced in R&D QA and was used to evaluate the products of all affiliates, new monthly and quarterly reporting systems were developed, and training of affiliates and licensees was begun.

Together with Purchasing, an overall rating of suppliers was established and published covering the period July, 1990 to June, 1991.

PM and competitor products continued to be closely monitored, with special attention given to the Italian market in view of the introduction of printed numbers.

Modifications of equipment and methods are being made in the smoking laboratory to accomodate the new ISO norms for cigarette smoke analysis, and correlations with the old norms will be established.

Objective: Implement a program which adequately addresses capacity requirements.

Highlights: Support was provided for the start-up and qualification of two new Legg dryers in PMG Berlin.

The start-up and qualification of two new P&S burley dryers in PMG Berlin is in progress.

Support for the FTR primary improvement program is being provided.

Assistance is being provided to both PM Europe Regions on the design of primary and stem operations.

An evaluation was made of BBS processing at PMG Munich.

Objective: Develop and implement programs focused on standardization of primary processes and tobacco materials.

Highlights: The Primary Information manual was completed for all four PM affiliates, an update was issued for BOZ and the Berlin update is in progress.

The primary process quality program is being transferred to QA, standardization of methods has been initiated, and the central analysis of cut rag is in progress.

An evaluation of Comas stem was conducted for MTI (Italy).

Assistance is being provided for the qualification of a new stem line in Poland.

The PMG Munich burley dryer standardization and capacity increase program was completed.

The automation of physical testing in the Process Development laboratory is in progress.

Program: **RECONSTITUTED TOBACCO**

Objective: Define, in collaboration with PM Europe Leaf and PM USA, our company's worldwide sheet requirements versus capacities and develop alternate sheet products.

Highlights: An evaluation of global PM sheet requirements and capacities has been initiated.

The European OTM situation was evaluated and a classification system was established for factory generated class tobaccos as feedstock for recon processing.

A program was initiated to evaluate the cast leaf product for potential use in Europe.

First trials were completed in an attempt to reproduce an RL-TC sheet at LTR.

Technical assistance was provided to Bandtabak Malchin (BTM) for process, product and methods improvements.

Reductions in the humectant level of the BTM sheet were achieved to meet German regulatory requirements.

Program: **EXPANDED TOBACCO**

Objective: Implement process and product quality improvements, standardization and adequate safety procedures in the four European ET facilities.

Highlights: Plant optimization and standardization of the European ET facilities was continued.

A program was established for the evaluation of a new ET feedstock processing line, containing DCC equipment, at FTR in Onnens.

The production of ET for Diana was transferred from PMG Munich to MTI Bologna and on-site assistance was provided for the qualification trials and quality follow-up.

Various blend expansion trials were successfully conducted at FTR in Onnens for requesters including the Swedish Tobacco Group and China.

Trials of Total Blend Expansion were conducted to support evaluation of the technology for new product development.

The New Expanded Tobacco (NET) program was initiated and will continue for the evaluation of European ET blends.

Assistance was provided to facilities to solve problems of the process gas, CO2 liquid and recovery systems.

A safety hazard review program was started and is continuing in collaboration with PM USA.

Program: **PRODUCT DEVELOPMENT**

Objective: Modify existing products and develop new products to meet Marketing, productivity, standardization and/or regulatory requirements.

Highlights: A reduced cost L&M full flavor to be sold in Belgium has been developed and is presently being tested among consumers.

Eight existing products now sold in Italy, including Muratti, Philip Morris Multifilter, Diana, Mercedes, and Philip Morris Lights Ultra Slim, have been modified in order to reduce tar and nicotine deliveries prior to the implementation of the labeling directives.

Marlboro and L&M products manufactured and sold in Eastern Europe have been standardized in terms of blend, flavor system and construction in order to be as close as possible to the Pan-Europe standard.

All PM products manufactured under licence by ATO in Finland have undergone an increase in length from 79 mm to 84 mm.

A new Muratti Lights with a concentric filter and a 4 mg Tar delivery has been developed and launched on the Swiss market.

Belmont Ultra with a concentric filter and a 1 mg Tar delivery has been introduced in Finland.

Marlboro Lights KS and 100's delivering 6 and 8 mg Tar respectively have been developed and may be introduced in the UK prior to the implementation of the labeling directives.

The development of a Multifilter Super Lights for Italy, delivering 3 mg Tar, was completed.

A new Ultra-Slim cigarette, delivering 4 mg Tar, has been developed and will be introduced in Italy early in 1992 as a Multifilter line extension.

A cigarillo type product with a performance similar to a full flavor cigarette has been developed and will be consumer tested in Germany during fall 1991.

A new low cost American Blend product has been developed and introduced, using the Karo Filter trademark, in the former East Germany.

Program: **NEW PRODUCT TECHNOLOGY**

Objective: Increase the effectiveness in technology management in order to improve product innovation, and create new and innovative ideas/concepts for the cigarette market.

Highlights: A study was completed demonstrating significant tobacco weight reductions, at constant firmness, through substantial increases in tobacco cut-width.

A very acceptable Marlboro product was developed using 500 mg of a fully cased and partially expanded blend.

A cigarette with a flat puff-by-puff profile was developed, using tube-in-tow technology, which did not show any significant product advantages in consumer testing.

The existing cigarette simulation model has been further improved by introducing the possibility of predicting the impact of combined and concentric filters on overall product performance.

Studies on the influence on sidestream smoke yields of modifications in cigarette design and/or materials are being completed.

The influence of tobacco wrappers, replacing cigarette paper, on mainstream and sidestream smoke deliveries has been studied, and the results are now being applied to the development of reduced sidestream cigarettes.

An extensive study was completed on the influence of key product design parameters on the enhanced performance of Ultra Low Tar products, and the main findings are being implemented in the Philip Morris Ultra improvement program.

A fractionation procedure was developed to isolate three components from oriental tobacco which might have biocidal activity and prevent tobacco spoilage, and testing of the inhibitory activity of these fractions is underway.

Literature studies, participation in international conferences, and visits to biotechnology research centers have been initiated in order to assess the current state of genetic engineering techniques for tobacco pest control.

Program: **PRODUCT EVALUATION/CONSUMER DESIRES**

Objective: Develop our understanding of consumer perceived product performance.

Highlights: In order to improve our understanding and interpretation of consumer test results, Product Development and Marketing Research have started the following program to redesign the standard questionnaire used in product tests:

- First half of 1991: qualitative studies on vocabulary conducted in Germany (West and East), Holland and Spain.

- Second half of 1991: same studies will be conducted in Belgium and Switzerland.

- By end 1991: a new standard questionnaire will be designed jointly with PMI Marketing Research Management with quantitative studies to validate the new concept to be conducted beginning 1992 in the above countries.

The major Blind Product Testing programs supported were:

- Marlboro Monitoring Program in the major EEC and EEMA markets (France, Holland, Belgium, Germany, Greece, Switzerland, Finland).

- Monitoring of Marlboro Lights (France, Switzerland), Philip Morris Super Lights (France, Belgium) and Merit (Switzerland).

The consistency and accuracy of our internal descriptive panel have been improved by the introduction of a "Monitor" cigarette which is smoked at the beginning of each session in order to calibrate the panelists prior to the profiling of the products, and a profiles data base, Sensory Profile Analysis (SPA), of competitive products as well as of cigarette prototypes has been created.

The development of the computerized model for correlating market dynamics with measurable and subjective properties has been completed, the model's evaluation and optimization are in progress, and the selection of competitive products which are to be analyzed and profiled has been finalized.

Program: **NEW PROCESS TECHNOLOGY**

Objective: Develop, evaluate and implement new processing technologies for potential application in PM facilities.

Highlights: The HT tunnel prior to the cut filler dryer in the Miniprimary was ordered and is scheduled for installation in September, 1991.

Trials were successfully conducted at Hauni in Hamburg to evaluate the recovery of cut filler from winnower stems.

Members of the technical staff participated in the New Primary Process Technology Meeting in Richmond.

The evaluation of the Comas puffing process was completed for stems and cut filler.

Discussions have been held with several equipment suppliers to explore technologies for primary improvements.

PM Europe R&D hosted the 33rd Tobacco Colloquium in Interlaken, with participants from 17 companies and 18 presentations being given.

Program: **ENVIRONMENTAL TOBACCO SMOKE**

Objective: Assess the impact of environmental tobacco smoke (ETS) on indoor air quality.

Highlights: Nearly 150 compounds collected from extinguished cigarette butts and profiled as odorous by headspace GC-sniffing have been identified by GC-MS-GC-FTIR.

A small smoking chamber has been constructed in which the kinetics and mechanisms of ETS aging can be studied under controlled conditions.

Methods for ETS monitoring continue to be assessed through collaborative studies within the industry.

Concepts for measuring ETS exposure are critically and continually being evaluated.

The determination of sidestream smoke visibility and yields of carbon monoxide, particulate matter and nicotine are routinely performed, and the monitoring of additional parameters is being assessed.

Program: **PESTICIDES, INGREDIENTS & THE ENVIRONMENT**

Objective: Ensure that blend components, nontobacco materials, finished products and packaging comply with existing and future legal requirements in both the EEC and EEMA Regions.

Highlights: Tobacco lots used by PM Germany and selected products from EEC countries were screened on a regular basis for pesticide residues and humectants, and the leading brands in several EEC countries were surveyed twice yearly.

Analytical support is being given to Packaging Development EEC and EEMA for the qualification of new materials such as water-based inks and varnishes.

The headspace-GC method for analysis of residual solvents on printed packaging materials has been set up in QA laboratories.

In conjunction with PM USA R&D, methods are being developed for the analysis of seven additional ingredients which will be forbidden in our products according to proposed German legislation.

Commercially available antibody-based kits are being evaluated to determine whether immunoassay technology could be a useful screening tool in tobacco pesticide analysis.

Significant reductions in running time have been gained by improving methods for checking flavor and tobacco sheet conformity to legal requirements.

PM Europe established a leading role in CORESTA for the development of a measurement method for firmness while smoking, and in the tobacco subgroup of the Swiss norm association for the new ISO norms for cigarette smoke analysis.

In conjunction with Packaging Services, a program was established for the improvement and standardization of packaging adhesives.

Joint work with Henkel and National Starch has resulted in the preliminary formulation of a subjectively acceptable, naturally based sideseam and tipping adhesive, and further improvements are in progress to address machinability issues.

APPENDIX D

APPENDIX D

Competitive Intelligence

Competitive Intelligence

A. Introduction

Competition within the worldwide cigarette industry continues to be intense. There has been considerable activity within the United States during the past twelve months with regard to new brand introduction particularly from R. J. Reynolds and the American Tobacco Company. The majority of this brand activity has been in the price value area; however, Reynolds has introduced new packings for Camel, Winston, and Dakota. American Brands has been particularly active, although none of their new brands or packings involves major developments within R&D. Nevertheless, American will be included in this write up along with the three companies that can be considered to have sufficient R&D resources to compete effectively with PM USA. These three companies are R. J. Reynolds, Brown & Williamson (BAT), and JTI.

B. R. J. Reynolds

1. Highlights

As pointed out above R. J. Reynolds has been quite active during the past twelve months. They have introduced a considerable number of new brands and packings. The most noteworthy of these introductions are Camel Ultra Lights, introduced nationally in January, 1991; the extension of the Horizon test market to St. Louis, Missouri, and Dallas, Texas, in March, 1991; the test market (about 50% of the United States) of Winston Ultra Lights King Size and 100's in a box packing in June, 1991; and the regional introduction in June, 1991, of Camel and Camel Lights 100 in a box packing which Reynolds is marketing as Camel Hard Pack 99. Reynolds has been quite active in advertising this last product with their "Hard Pack" campaign.

In addition to new brand introductions Reynolds has made major changes to many of their brands. In almost all cases these changes involve a reduction of 5% in expanded tobacco, an increase in tobacco weight, and an increase in puff count. In making these changes there are often significant changes in tar/puff and nicotine/puff. This topic will be discussed in considerable detail below. Reynolds has essentially completed the conversion of all their cigarettes from flax paper to wood pulp paper. The only exception is Now. Although this move is primarily in order to decrease costs, they have taken advantage of the fact that wood pulp paper is whiter than flax paper by claiming that Winston, at least, has improved quality. A further change involves a new overwrap for Winston packs. This overwrap is a metallized

film similar to the Premier wrapper, although much thinner, and is being marketed as a quality improvement. Other cost cutting measures include switching completely from glycerine to sorbitol, saving $0.20/lb, and eliminating the use of propylene glycol for pre-conditioning tobacco (1/3 of their total use).

Although much of Reynolds' activity during the past twelve months is clearly driven by a desire to cut costs, some is undoubtedly a result of the fact that sales of their full margin brands are significantly declining. Maxwell data for the first six months of 1991, showed that Reynolds has experienced a decline of 9.1% compared to the same period of 1990. This decline is significantly greater than those experienced by the other domestic companies. Most of this decline can be attributed to the poor performance of Winston, Vantage, and Salem. Reynolds appears to be responding to this market decline by attempting to increase sales through couponing and repositioning branded generics as third tier products. The most noteworthy change is the repositioning of both Magna and Sterling to the third tier category in May, 1991.

2. New Products

a. New Product Introductions - Reynolds has introduced the following new products during the past twelve months.

(1) Sterling 100 Regular and Menthol were introduced nationally in November, 1990. The regular version delivers 16 mg tar and 1.1 mg nicotine, while the menthol version delivers 18 mg tar, 1.3 mg nicotine, and 0.6 mg smoke menthol.

(2) Camel Ultra Lights King Size, Soft Pack and Box, and Camel Ultra Lights 100 Box were introduced nationally in January, 1991. The King Size Soft Pack cigarette is 84 mm with a delivery of 6 mg tar and 0.5 mg nicotine. The King Size Box cigarette is 83 mm with a delivery of 6 mg tar and 0.5 mg nicotine. The 100 mm Box product delivers 6 mg tar and 0.6 mg nicotine.

(3) Dakota King Size and Dakota Lights King Size were introduced in a Slide Box packing in Arizona. These 83 mm products are modifications of Dakota Long Size Box and Dakota Lights Long Size Box. The full flavor delivers 19 mg tar and 1.3 mg nicotine, while the lights product delivers 13 mg tar and 1.0 mg nicotine.

(4) Horizon King Size Regular and Menthol were test marketed in St. Louis Missouri, and Dallas, Texas, in March, 1991. These two cities were added to the original test market in Atlanta, Georgia. Both cigarettes deliver 12 mg tar and 0.9 mg nicotine. The menthol version delivers 0.5 mg menthol. These cigarettes release ethylvanillin into the sidestream through the use of ethylvanillin glucoside coated onto the cigarette paper.

(5) Dakota King size and 100's and Dakota Lights King Size and 100's were introduced in Box packings in Nashville, Tennessee, and Houston, Texas, in June, 1991. Dakota King Size Box delivers 18 mg tar and 1.4 mg nicotine; Dakota 100 Box delivers 17 mg tar and 1.2 mg nicotine; Dakota Lights King Size Box delivers 12 mg tar and 1.0 mg nicotine; and Dakota Lights 100's Box delivers 12 mg tar and 0.9 mg nicotine.

(6) Winston Ultra Lights King Size Box and Winston Ultra Lights 100 Box were test marketed in about 50% of the US in June, 1991. The King Size Box cigarette has a smaller circumference (24.5 mm) than the corresponding Soft Pack cigarette (24.9 mm), and delivers 5 mg tar and 0.5 mg nicotine. The 100's Box packing also has a smaller circumference (24.2 mm) than the Soft Pack (24.9 mm), and delivers 5 mg tar and 0.5 mg nicotine.

(7) Camel 99's and Camel Lights 99's were introduced in box packings in Arizona, California, Idaho, New Mexico, Oregon, Utah, and Washington on July 1, 1991.

In addition to the introductions listed above, RJR has test marketed 83 mm box packings of Camel KS, Camel Lights KS, Magna KS, Magna Lites KS, Winston Lights KS, and Winston KS in a number of cities. These products are expected ultimately to replace the long size box packings.

b. New Brand Performance

It is of considerable significance that all but one of the above new product introductions involve full margin brands. Camel is clearly the best performing of Reynolds' full margin brands, in terms of growth, and therefore it is not surprising that it has dominated new full margin brand activity during the past twelve months. Three packings of Camel Ultra Lights, a new entry in the Camel family, were introduced nationally in January, 1991. It

seems reasonable to assume that this product was introduced to beat Marlboro Ultra Lights to the marketplace. Philip Morris did not counter this introduction, however, as Reynolds may have expected, by introducing the Ultra Lights product nationally, but rather by the national introduction of Marlboro Medium. Based on performance of Camel Ultra Lights to date, it would appear that this strategy was sound in that the brand has not performed particularly well. As of August, 1991, it had a 0.4% share. In fact Camel Ultra Lights is being dropped in some chains within Region 5 (Western US) to facilitate the introduction of Camel 99's (see below).

The strategy behind the introduction of Camel 99's is quite different from that which prompted the introduction of Camel Ultra Lights. Camel has had some success in cutting into Marlboro's share with young adult smokers. Camel 99 clearly intends to build upon this success. Neither Camel full flavor nor Camel Lights has been previously available in a 100 mm box packing. The advertising campaign - The Hard Pack - for this brand is clearly tailored to appeal to young adults. Moreover, the description of the brand as a 99 rather than a 100 mm cigarette is intended to differentiate it from competitive brands and give it an identity of its own. This approach may also appeal to young adults. The status of this new brand in the marketplace should be monitored carefully. Two months after its introduction it had a 0.2 retail share in the western US market.

The second full margin brand which has received considerable attention from Reynolds in the past twelve months is Dakota. Dakota 80 Box and Dakota Lights 80 Box were originally test marketed in Texas and Tennessee in March, 1990, as a potential direct competitor for Marlboro. Reynolds followed up this introduction in January, 1991, with a test market in Arizona of two packings, full flavor king size and lights king size, in a new type of packaging - a slide box. Despite the new packaging, as well as extremely aggressive promotion of the product, Dakota is not doing particularly well in the Arizona test market. RJR is making every attempt to target this product against Marlboro. For instance, there was a "Dakota Profit Plus Program" in effect from February 18 to June 30, 1991. If store personnel are wearing an "Ask Me About Dakota" button, they are paid $5.00. If store personnel get a consumer to purchase Dakota instead of Marlboro in the presence of an RJR salesman, they receive $50.00. In June, packings of Dakota in the original test market sites were increased by adding 100 mm packings for both the full flavor and lights versions. Based on test market results to date for the soft pack entries, this brand would not seem to constitute a threat.

The last product to be discussed is Horizon. Horizon was initially introduced into test market in Atlanta, Georgia, in June, 1990. At that time it was the first attempt to market the concept of "the first cigarette that smells good" in a full circumference presentation. Horizon generates a vanillin-smelling sidestream aroma generated through the thermal decomposition of ethylvanillin glucoside which has been coated onto the paper. Chelsea, a 23 mm product which utilized the same technology, had already been introduced into three test markets. Performance of Horizon in Atlanta was judged to be sufficiently good, 0.4 market share, to warrant the addition of two additional test markets - St. Louis, Missouri, and Dallas, Texas, in March, 1991. It is too early at this time to obtain any meaningful read-out as to how Horizon is doing in the new test markets. Chelsea has not performed as well in test market, and it is being withdrawn. Despite the low market share achieved by Horizon, it is possible that it is high enough to allow Reynolds to profitably introduce this product nationally. If they do go national with the product, it is likely to be some time in late 1992.

3. Changes to Existing Brands

Reynolds has made extensive changes to their existing brands during the past twelve months. The two most significant changes are that they are now using wood pulp paper on all of their brands with the exception of Now, and they have significantly decreased the level of ET in many of their brands. Conversion from flax to wood pulp paper has been phased in gradually, starting in August, 1990, and completed in April, 1991. The change from flax to wood pulp paper is primarily a cost-saving measure. On average, wood pulp paper runs about $0.07 less per thousand cigarettes than does flax. On the other hand Reynolds has utilized the fact that wood pulp paper is whiter than flax paper to promote the image of higher quality for Winston in their advertising. It is interesting to note that we have been able to determine if the wood pulp paper on a Reynolds cigarette is obtained domestically or from a European supplier. Precipitated calcium carbonate can be obtained in two morphological forms - calcite or aragonite. Domestic chalk is always exclusively 100% calcite. Both domestic suppliers take great pains to eliminate aragonite from their calcium carbonate, since aragonite has a greater tendency to dust. European suppliers, on the other hand, use mixtures of the two forms. Most of them prefer to include some aragonite in their chalk because aragonite tends to have greater whiteness. We have picked up both types of papers on Winston in the past few months.

The second major change is the reduction of ET in some of their brands. This change started in late 1990, and appears to be continuing. Reductions are all about

5%, i.e., from 21 to 16%, from 16 to 12%, and from 12 to 7%. Reduction of ET in their brands is most likely a result of the fact that freon 11, the agent they use for expanding their tobacco, must be phased out of use by the year 2000 according to the Montreal protocol. Although they could continue to use it at this time, there are two compelling reasons to attempt to use as little as possible. The first is cost. One result of the Montreal protocol is to impose a tax, which increases each year, on the sale of freon. As a consequence, freon 11 cost has increased in the last year from $0.95/lb to $2.37/lb. The second reason involves potential adverse publicity. The reduction of expanded tobacco increases tobacco weight, and Reynolds has clearly taken a significant weight increase on all brands they have changed to date, in many cases by considerably more than would be expected based simply on the decrease of ET. The additional weight increase may be an attempt to improve quality (firmness), or it may be a consequence of the need to use less expensive tobaccos (see below). The increase in weight would be expected to have a significant cost effect. Some of the cost effect is mitigated by the fact, discussed above, that freon costs have increased significantly. In addition there is information that Reynolds is keeping costs down by the use of less expensive tobacco. Although there is some speculation that Reynolds can afford to use less expanded tobacco because of the large number of steaming tunnels, installed in Tobaccoville when it was built, which allow the total filling power of the blend to be increased to some extent, the fact that they did take significant weight increases suggests that this effect is not large. Lastly, it should be noted that Reynolds has licensed the PM USA DIET process, and should have their own DIET facility on-line in late 1991.

The decrease in ET levels discussed above is not the first major change RJR has made to their tobacco weight and density in the last few years. In late 1988 they took an across-the-board weight increase of about 5%, and in mid-1990 ET on the most of their brands was reduced about 4-5 percentage points. These changes were made with a minimum effect on tar and nicotine deliveries as well as puff count. The current reduction in ET for Reynolds' brands has been accompanied by changes in tar delivery, nicotine delivery, and puff count. Some of these changes are quite significant, and appear to be far greater than would result simply from the changes in ET and tobacco weight. Moreover, there is no consistency in these changes. Tar delivery can increase (Winston 85), decrease (Winston Lights 100 Box), or remain the same (Winston Lights KS Box). Tar/puff either remains the same or decreases. Nicotine delivery tends to follow the same trend as tar delivery, although Winston 85 shows an increase in nicotine/puff. Puff count invariably increases. At this time the logic behind these changes is difficult to understand. As already mentioned, nicotine/puff increases for Winston 85. Could this be an attempt to provide the smoker more nicotine which might be regarded as a competitive advantage? Possibly;

however, no other brand was changed in this manner. The fact that puff count increased might have been an attempt to decrease mass burn rate; however, in most cases the increase in tobacco weight negates the increase in puff count. It does appear that for three brands, there may be a decrease in mass burn rate. An increase in puff count could be a consumer issue; i. e., more puffs for your money. If this is the case, they do not seem to be using it as a marketing tool. However an increase in puff count as a quality advantage has been mentioned by RJR personnel in a number of recent articles discussing these changes. At this point all we can do is monitor the situation extremely closely and continue to obtain more information. Data outlining the changes in cigarette construction and cigarette properties for those brands which have been changed in the past twelve months are given in Table 1.

4. RJR Brand Performance

Reynolds sales, based on the second quarter Maxwell Report, have declined almost 9.1% year-to-date for the first six months of 1991 as compared to the corresponding period in 1990. Although full margin brands, particularly Winston (17.4%) and Vantage (15.8%), have experienced the greatest decline, even Reynolds' price value brands are not performing well compared to the growth of price value overall. RJR's total price value sales increased by 13.0% compared to an increase of 43.0% for the remainder of the industry. The performance of Reynolds' major full margin brands over the past twelve months is shown in Figure 1, while the performance of their major price value brands is given in Figure 2.

In order to attempt to increase market share, Reynolds repositioned both Magna and Sterling as sub-generics in May, 1991. This move will result in the immediate increase in the penetration of this price tier in Nielsen stores from 77% to about 88%. This increase in penetration will bring the segment to environments that thus far had resisted sub-generics, and will likely afford distribution opportunities for other third tier brands, including Bristol. Although this move is a potential threat to PM brands, Reynolds is currently not expending a great deal of marketing effort to promote this repositioning. One step which has been taken to promote these brands in some areas is the use of $1.00 coupons. In some areas Magna is selling for as little as 69 cents a pack and $6.50 a carton.

More surprising than the repositioning of Magna and Sterling is the fact that

Winston, Salem, Camel and Vantage shipped sticks

in 1991

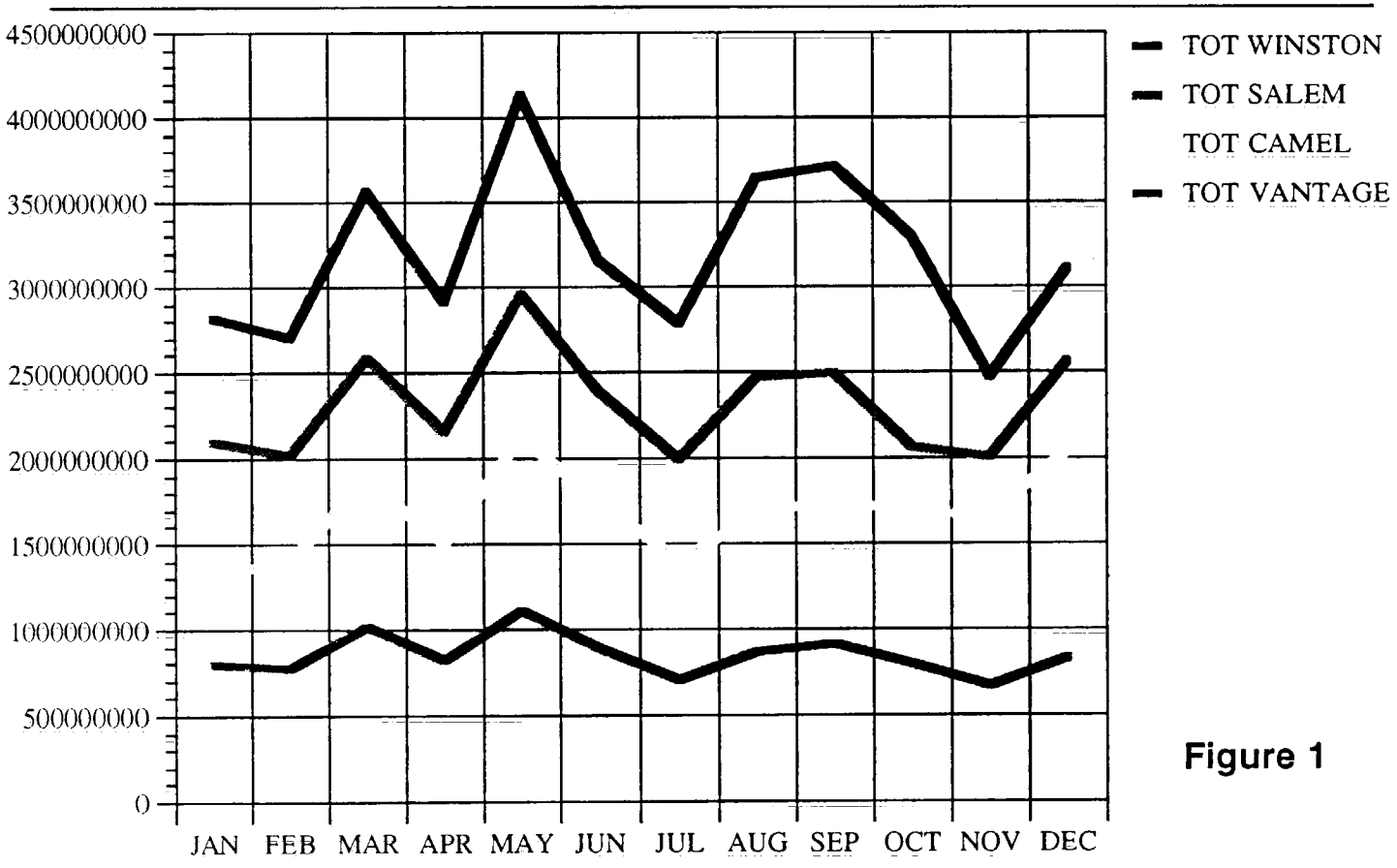

Figure 1

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Doral, Magna Century and Sterling PV shipped sticks in 1991

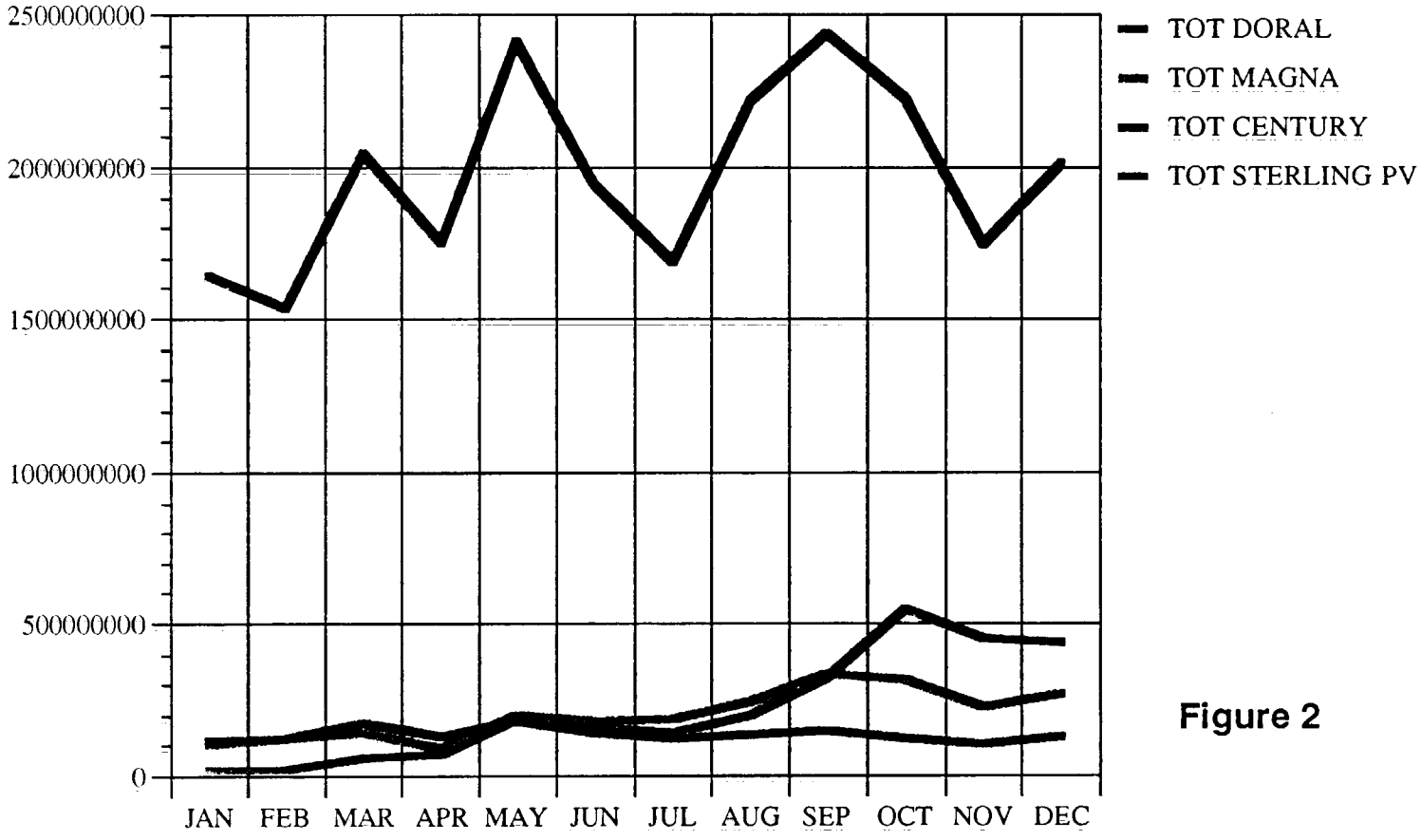

Figure 2

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Table 1
Physical and Smoking Parameters for RJR Brands

Brands Reported in January, 1991

	Winston 85		Winston Ultra Lights	
	Old	New	Old	New
FTC Tar (mg/cigt)	15.8	19.3	6.3	6.4
Nicotine (mg/cigt)	1.09	1.56	0.51	0.53
Puffs/cigt	8.3	9.9	7.1	8.5
Tar/puff	1.88	1.95	0.89	0.75
Nicotine/puff	0.13	0.16	0.07	0.06
Total RTD (mm H2O)	118	98	119	118
Paper component (%)	0.5	0.5	1.2	0.5
Permeability (Coresta)	24	25	25	24
Filter RTD (mm H2O)	78	65	128	128
Fiber denier	3.6	3.1	2.4	2.4
Ventilation (%)	7	18	46	46
Tob. wt. (g)	0.712	0.752	0.605	0.651
ET (%)	12	7	21	16

	More 120		More Menthol 120	
	Old	New	Old	New
FTC Tar (mg/cigt)	15.4	17.5	14.7	18.3
Nicotine (mg/cigt)	1.12	1.28	1.18	1.42
Puffs/cigt	11.4	12.6	11.6	13.1
Tar/puff	1.35	1.39	1.27	1.40
Nicotine/puff	0.13	0.16	0.07	0.06
Total RTD (mm H2O)	167	159	161	156
Paper component (%)	1.2	1.2	1.1	1.3
Permeability (Coresta)	15	16	16	16
Filter RTD (mm H2O)	118	115	117	116
Fiber denier	4.7	5.4	4.9	5.4
Ventilation (%)	31	31	32	30
Tob. wt. (g)	0.721	0.734	0.720	0.738
ET (%)	16	12	16	12

Table 1 - Continued
Physical and Smoking Parameters for RJR Brands

	Doral FF 100		Salem Lights 85	
	Old	New	Old	New
FTC Tar (mg/cigt)	14.4	16.1	9.5	10.4
Nicotine (mg/cigt)	1.03	1.20	0.70	0.78
Puffs/cigt	8.1	8.5	7.1	7.5
Tar/puff	1.78	1.89	1.34	1.39
Nicotine/puff	0.12	0.14	0.10	0.10
Total RTD (mm H2O)	129	129	126	130
Paper component (%)	0.5	0.5	0.9	0.9
Permeability (Coresta)	23	24	37	35
Filter RTD (mm H2O)	83	80	107	110
Fiber denier	2.5	2.5	3.4	3.4
Ventilation (%)	0	0	21	22
Tob. wt. (g)	0.698	0.727	0.633	0.674
ET (%)	25	21	16	12

Brands Reported in April, 1991

	Vantage 100	
	Old	New
FTC Tar (mg/cigt)	9.6	9.4
Nicotine (mg/cigt)	0.75	0.74
Puffs/cigt	9.2	11.1
Tar/puff	1.03	0.86
Nicotine/puff	0.08	0.07
Total RTD (mm H2O)	135	117
Paper component (%)	0.9	0.5
Permeability (Coresta)	37	23
Filter RTD (mm H2O)	121	122
Fiber denier	2.6	2.4
Ventilation (%)	35	51
Tob. wt. (g)	0.771	0.841
ET (%)	16	12

Table 1 - Continued
Physical and Smoking Parameters for RJR Brands

Brands Reported in June, 1991

	Winston Lights KS Box		Winston Lights 100 Box	
	Old	New	Old	New
FTC Tar (mg/cigt)	9.9	9.9	10.9	9.5
Nicotine (mg/cigt)	0.69	0.74	0.82	0.77
Puffs/cigt	7.7	8.8	9.2	10.3
Tar/puff	1.28	1.12	1.18	0.92
Nicotine/puff	0.09	0.08	0.09	0.07
Total RTD (mm H2O)	140	143	145	124
Paper component (%)	0.5	0.5	0.5	0.6
Permeability (Coresta)	27	24	38	41
Filter RTD (mm H2O)	114	117	120	120
Fiber denier	2.1	3.0	3.1	3.4
Ventilation (%)	17	23	19	37
Tob. wt. (g)	0.619	0.693	0.733	0.778
ET (%)	12	7	12	7

	Winston Lights 100		Camel Lights 100	
	Old	New	Old	New
FTC Tar (mg/cigt)	11.2	11.4	11.5	11.4
Nicotine (mg/cigt)	0.83	0.85	0.85	0.84
Puffs/cigt	9.5	10.4	9.5	10.1
Tar/puff	1.18	1.10	1.20	1.13
Nicotine/puff	0.09	0.08	0.09	0.08
Total RTD (mm H2O)	113	113	111	113
Paper component (%)	0.5	0.5	0.5	0.5
Permeability (Coresta)	40	40	38	39
Filter RTD (mm H2O)	91	104	90	93
Fiber denier	2.6	3.3	2.6	2.6
Ventilation (%)	26	33	26	27
Tob. wt. (g)	0.775	0.800	0.771	0.796
ET (%)	12	7	12	7

Table 1 - Continued
Physical and Smoking Parameters for RJR Brands

	Doral KS Menthol		Doral 100 Menthol	
	Old	New	Old	New
FTC Tar (mg/cigt)	16.9	17.3	16.0	16.8
Nicotine (mg/cigt)	1.22	1.25	1.22	1.26
Puffs/cigt	8.2	9.3	8.6	9.6
Tar/puff	2.06	1.86	1.86	1.75
Nicotine/puff	0.15	0.13	0.14	0.13
Total RTD (mm H2O)	105	106	122	122
Paper component (%)	0.5	0.5	0.5	0.5
Permeability (Coresta)	25	25	25	24
Filter RTD (mm H2O)	64	64	74	73
Fiber denier	3.0	3.0	2.5	2.5
Ventilation (%)	8	12	None	7
Tob. wt. (g)	0.665	0.738	0.711	0.812
ET (%)	21	16	21	16

Reynolds is currently bringing Doral to a sub-generic price point in a select group of independent accounts in New England (Maine, New Hampshire, and Massachusetts) and Texas. Payment is made to retailers with either cash or coupons. Whether they intend to extend this strategy or not remains to be seen.

5. R&D Organization

Information obtained from two different sources clearly confirms the fact that the RJR Tobacco Research Center is declining in numbers. Unpublished information indicated a size of 750, which is reasonably consistent with a size of 687 reported in the "Directory of American Research and Technology, 1991." This number has been broken down into 401 professionals, 87 of whom have doctorates, and 286 technicians and auxiliaries. Despite the fact that this number of 687 is published, it is self-reported, and therefore should not be assumed to be exactly correct. RJR recently announced that they had eliminated 200 positions within RJR Tobacco in Winston-Salem. Of the 200 positions, 150 were hourly workers, while 50 were executive and administrative personnel including supervisors, engineers and office staff. One local newspaper indicated that R&D had been particularly hard hit. We have information which indicates that 25-35 of those who were let go came from R&D. Most, if not all of these individuals, were engineers. A large majority of the employees left of their own volition to take advantage of new severance and early retirement benefits. The new terms for early retirement now apply to workers over age 50 with at least 10 years of service. Severance pay was set at two weeks pay for each year of service. In the white collar area, about one-third of those who left did so voluntarily, while the remaining two-thirds simply had their jobs eliminated. Taking this most recent change into account, our current estimate for the RJR R&D staff is about 650. It would appear that the number will continue to shrink, perhaps by as many as 75, in the near future.

Even with the recent cuts within RJR's R&D Department, their staff is still larger than PM USA R&D. It is considerably larger when placed on a per cigarette sold basis. A direct comparison is difficult to make because the numbers quoted do not include any contribution for RJR International. On the other hand, their Research Center does include a "Smoking and Health Group" and Engineering and Leaf functions which are not included in the PM USA R&D Department. These adjustments have been made to obtain a direct functional comparison in Table 2, and the final number is normalized on a per cigarette sold basis. As can be seen from Table 2, the RJR Research Center is still considerably larger than that at PM USA.

Table 2
Comparison of RJR and PM USA Research Center Headcount on an Adjusted Basis

	RJR	PM USA
Nominal	650	577
-RJR Leaf Function (15)	635	577
-RJR Engineering Function (20)	615	577
-PM USA Service to PMI (14)	615	563
+PM USA INBIFO (112)	615	675
Headcount per Billion Units Sold Based on Previous 12 Month Volume	4.17/billion	3.05/billion

One significant change has taken place within the executive management group of the RJR Research Center. Bob DiMarco, Senior Vice President, Research and Development, now reports directly to James Johnston, CEO of R. J. Reynolds Tobacco, rather than to David K. Isbister, Executive Vice President, Manufacturing and Technology. Apparently this change was made at the request of Mr. Johnston to enable him to become more familiar with the RJR Research Center. It is still rumored that DiMarco will retire in late 1991 or in 1992. At present his most likely replacement would appear to be Dr. Gary Burger, Vice President, Advanced Technology Products. Burger's influence within R&D seems to have increased, and there are indications that both Mary Stowe, Vice President, Product & Applied Technology, and Robert Lloyd, Vice President, New Product Technologies, report directly to Burger. Both A. W. Hayes, Vice President, Biological R&D, and W. M. Hildebolt, Vice President, Administrative & Technical Services, continue in their previous positions.

Biological R&D is divided into two Directorates, Biobehavioral & Sensory Evaluation, and Toxicology Research. Biobehavioral & Sensory Evaluation consists of three Divisions: Environmental Tobacco Smoke, Biobehavioral Research, and Sensory Evaluation. Toxicology Research is also divided into three Divisions: Applied Toxicology, Pharmacology Research, and Cellular & Molecular Biology. Management personnel we have identified to date in this area are J. H. Reynolds, Manager of Biobehavioral Research; M. R. Savoca, Manager of Sensory Evaluation; P. A. Crooks, Manager of Applied Toxicology, and J. D. deBethizy, Manager of Pharmacology Research. There are indications that RJR will no longer carry out an active research program in the area of environmental tobacco smoke. Apparently Guy Oldaker, the Senior Scientist in the ETS area, has been requested to find another area of research. The ETS group was a relatively large group consisting of at least twelve individuals, some of whom are quite prominent RJR scientists.

Product & Applied Technology consists of three Directorates, Brands Technology, Brands R&D, and Basic Research. Brands Technology consists of two Divisions: Flavor Technology and Product Design Technology. W. M. DuFour is the Director of Brands Technology, and B. M. Lawrence is the Manager of Flavor Technology. Brands R&D consists of three Divisions: Tobacco Standards, Brands R&D, and Statistics. R. L. Willard is the Director of Brands R&D, J. M. Rivers is the Manager of Tobacco Standards, and L. J. Inman is the Manager of Brands R&D. Lastly, Basic Research also consists of three Divisions: Analytical Chemistry, Aerosol Research, and Chemical Research. J. F. Elder is the Manger of Analytical Chemistry, B. J. Ingebrethsen is the Manager of Aerosol Research, and J. P. Dickerson is the Manager of Chemical Research. It is possible that emphasis on aerosol research at RJR is declining. At least two of the key people in the Division have been moved in

the last year or so. David Townsend, a Master Scientist, was previously moved to head a group working on Advanced Technology Products. Janet Wheeler has been made Manager of R&D Planning. It is worthwhile to note that there are two Program Managers who report to the Manager of Chemical Research: R. A. Heckman, Program Manager of Organic Chemistry, and a Program Manager of Radiochemistry. Despite the fact that there would appear to be a moderately sized organic chemistry group, we have recently learned that at this time there is only one practicing organic chemist at the RJR Research Center. This individual is Dwo Lynm, who is currently working in the area of radiolabelled synthesis. It is not known at this time whether the organic chemistry group has been disbanded, or if the members of the group are working on other projects. We do know that Tom Perfetti, who is currently listed as a member of the organic chemistry group and is a Master Scientist, is no longer working in this area.

New Product Technology is Divided into two Directorates: Product Technology & Development, and Process Technology & Development. Product Technology & Development has four Divisions: Mechanical Fabrication, Applied Packaging Technology, Materials Development, and Development. M. G. Woempner is the Group Manager of Mechanical Fabrication, J. P. Butler is the Manager of Applied Packaging Technology, L. H. O'Connor is the Manager of Materials Development, and M. D. Shannon is the Manager of Development. Process Technology & Development is divided into five Divisions: Process R&D, Manufacturing Process Engineering, Process Development, Process Engineering, and Optical Technology. D. R. Pugh is the Director of Process Technology & Development, G. D. Culp is the Manager of Manufacturing Process Engineering, and R. A. Merricks is the Program Manager of Process Engineering.

Administrative & Technical Services is divided into two Directorates: Technical Services and Administrative Services & Agricultural Sciences. Technical Services is divided into four Divisions: Scientific Information, Analytical Services, Quality Assurance and R&D Planning. H. C. Threatt is the Director of Technical Services, B. T. Hodge is the Manager of Analytical Services, and J. P. Wheeler is the Manager of R&D Planning. C. T. Mansfield, who reports to the Manager of R&D Planning, handles the RJR R&D competitive intelligence function. Administrative Services & Agricultural Sciences is divided into three Divisions: Safety/Maintenance Engineering, Agricultural Sciences, and Personnel Administration. B. V. Hardin is the Director of Administrative Services & Agricultural Sciences, D. L. Davis is the Manager of Agricultural Sciences, and S. Clapp is the Manager of Personnel Administration.

The full organization chart for the RJR Tobacco Research Center is included at the end of this section (Attachment 1). Also included is a complete list of all of their R&D employees, in alphabetical order, including individuals who have since left the company as well as individuals who have not yet been assigned to a specific group within the organization.

Two other points we have learned about the R&D organization are worth noting. The first is that as we had previously surmised, the R&D Computer Application Division is quite small compared to PM USA. The group consists of a total of about twelve individuals, two-thirds of which are professionals. The other point is that the RJR Research Center is now organized by major programs, seemingly much as is the PM USA Research Center. There are about ten major programs. Chemical Senses is one of the major programs. We do not have firm identification of any of the others; however, we can surmise that an optical processing program, aerosol research, and two or three product and process development programs are included.

6. Patents and Publications

Reynolds continues to be extremely active with respect to patenting. In the twelve month period from July 1, 1990, to June 30, 1991, they had 41 issued US patents, 14 EPO Publications, 1 Canadian patent, and 1 UK patent. The speculation made last year that the small number of EPO Publications assigned to Reynolds suggested a decline in patents for future years does not seem to have been borne out as of yet. The category with the largest number of patents is still improvements to Premier (8 US patents and 3 EPO Publications). There are five US patents in the area of on-line inspection devices. These patents include techniques such as optical inspection devices, infra-red radiation for the detection of loose ends, a sensing device to detect metal in a cigarette, and a near infra-red technique to determine menthol. The only other category with more than four patents involves non-burning articles, with two US patents covering electrical devices and three US patents covering chemical devices.

Several of these patents are of strategic importance. The two US patents describing electrical devices, US 4,947,874 and US 4,947,875, describe essentially identical devices with different uses. US 4,947,874 teaches the use of the device as an "electric cigarette," while US 4,947,875 describes the article as an aerosol delivery device. Reynolds continues to work in the area of reduced sidestream smoke cigarettes. One of the patents, US 4,941,485, describes a low sidestream cigarette which uses what is essentially the Ecusta magnesium hydroxide low sidestream wrapper, while US 4,998,541 claims a wrapper similar to that used above with the incorporation

of an alkali metal salt in the wrapper. A patent of particular significance, US 4,941,486, covers the use of any thermally labile flavor-release system applied to cigarette paper for the purpose of modifying sidestream aroma. This patent is of concern to PM USA because it has extremely broad coverage. US 4,979,521 claims a method for the high speed manufacture of cigarette rods of controlled integrity by way of a process which introduces water through the tongue. US 4,962,774 teaches a method for the production of reconstituted tobacco with ammonia incorporated therein, an area which has been of interest to PM USA for some time. US 4,962,773 describes a method for expanding tobacco after the cigarettes have been made using supercritical propane, while US 5,012,826 describes a similar method using a mixture of supercritical propane and carbon dioxide. US 4,971,077 teaches a method for on-line monitoring of menthol in tobacco using a near infra-red technique. US 4,995,405 discloses a technique for directly inserting a liquid into the tobacco during cigarette manufacturing. This is the second patent claiming such a method that Reynolds has obtained. EP 404,473 teaches a method for expanding tobacco using sulfur hexafluoride.

There is a group of four EPO Publications (419,733; 419,974; 419,975; and 419,981) which describe smokable fillers - mixtures of tobacco with other materials such as calcium carbonate, pyrolyzed cellulose, etc. These patents are of interest because the cigarettes claimed using these fillers are specified to have low porosity wrappers (5 Coresta). Since no claim for reduced sidestream smoke is made for these cigarettes, it is reasonable to assume that the low porosity wrappers are used to provide lower burn rate and, therefore, lower ignition propensity. It is possible that RJR may attempt to use an "extended" tobacco in low burn rate cigarettes, if such cigarettes are mandated, in order to cut costs. A list of all of the RJR patents classified by subject is shown in Table 3.

R. J. Reynolds had 23 publications for the period starting on July 1, 1990. The three areas with the most publications are toxicology (5), analytical chemistry (4), and smoke chemistry (4). Two of the toxicology papers and two of the smoke chemistry papers deal with Premier. The subjects of the remaining publications are as follows: biochemistry (3), chemical senses (2), entomology (1), ignition propensity (1), nitrosamines (1), aerosol research (1), and ETS (1). It is interesting to note the fact that there was only one ETS publication. It should also be noted that the ignition propensity publication is the first on this subject from RJR.

Reynolds may be doing more than simply publishing in the area of ignition propensity (also, see above). A recent Winston Lights model which was mail-out

Table 3
RJR Tobacco Patents from July 1, 1990, to June 30, 1991

Premier Type Articles
8 US Patents
3 EPO Publications

Non-Burning Articles
5 US Patents

Reduced Sidestream Cigarettes
3 US Patents

Reconstituted Tobacco
2 US Patents

Smokable Fillers
4 EPO Publications

Solvent Removal of Nicotine
1 US Patent

Cigarette Testing Equipment
1 US Patent

Tobacco Sparging
1 US Patent

Cigarette Filters
1 US Patent
2 EPO Publications

Automated Warehouse Placement System
1 EPO Publication

Tobacco Extracts
1 EPO Publication

Expanded Tobacco
3 US Patents
1 EPO Publication

On-Line Inspection Devices
5 US Patents

Sidestream Odor Modification
1 US Patent

Tobacco Processing
3 US Patents

Cigarette Manufacturing Technology
2 US Patents

Chemical Senses
1 US Patent

Tobacco Processing Equipment
1 EPO Publication

Variable Dilution Filter
1 US Patent

Advertising Devices
1 US Patent
1 UK Patent

Automated Cargo Loading System
1 US Patent

Tobacco Testing Equipment
1 US Patent
1 EPO Publication
1 Canadian Patent

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tested in June used a wrapper with a base porosity of 10 Coresta (calculated) which had been perforated to 120 Coresta. This base porosity was calculated using the PM USA R&D design program and adjusting the base porosity, after all other changes were made, to best approximate tar delivery, nicotine delivery, and puff count. Despite the fact that this cigarette contains no expanded tobacco, calculated mass burn rate has decreased from 57 to 45 mg/min. It is likely that the wrapper was perforated in an attempt to improve the subjectives of a cigarette which utilizes a low porosity paper. The observed cigarette delivery and construction parameters for a standard Winston Lights KS and the cigarette used for mail out testing, as well as the calculated values using the design program, are given in Table 4. The possibility of RJR beginning to move toward low ignition propensity cigarettes should be monitored carefully.

RJR's technical strategy appears to be somewhat better defined by their patents then it has been in previous years. One observation that is quite striking is the number of patents, utilizing a number of different techniques, dealing with on-line monitors. It would appear that they consider process monitoring within their factories to be a strategic goal. They also have devoted considerable effort to the area of tobacco processing to obtain natural tobacco "flavor concentrates." This material could be utilized in a Premier type article, a non-burning article, an ultra-low delivery cigarette, or a low burn rate cigarette. They continue to patent new aspects of a Premier type article. It would appear that they are continuing to work in this area and still consider the development of a product of this type to be a strategic goal.

7. RJR Products Using New Technology

RJR is clearly working in three areas involving products which incorporate new technology. The first, which is already in test market, is Horizon - a product which incorporates a flavor-release agent in the cigarette paper (ethylvanillin glucoside) which releases ethylvanillin to produce a vanilla odor in the room when these cigarettes are smoked. The specific technology used in Horizon was actually developed by Ecusta, although Reynolds had done some work in the area of flavor-release compounds in the past. The fact that they had worked in this area at one time allowed them to obtain broad patent coverage on this technology which may cause problems for PM. The second type of product is a low sidestream cigarette. We are aware of the fact that Reynolds mail-out tested at least one low sidestream cigarette in late 1990 or early 1991. Once again, the technology utilized for this product was developed at Ecusta, and once again Reynolds was able to obtain patent coverage, although specific coverage, on Ecusta's technology. Lastly, as mentioned above,

Table 4

Observed and Calculated Data for an Unidentified 84 mm Cigarette
Mail-Out Tested by RJR

	Winston Lights King Size (84 mm) Cigarette Observed	Unidentified King Size (84 mm) Cigarette Observed	Unidentified King Size (84 mm) Cigarette Calculated
Butt Length (mm)[1]	38	38	38
FTC Tar (mg/cigt)	9.1	10.4	9.8
Nicotine (mg/cigt)	0.66	0.79	0.72
Puffs/cigt	7.3	8.8	9.5
Cigarette RTD (mm H20)	120	114	114
Cigarette Length	83.7	83.7	83.7
Static Burn Time (min)[2]	7.8	ND[3]	10.2
Mass Burn Rate (mg/min)[2]	57	ND	45
Circumference (mm)	24.9	24.8	24.8
Wrapper Component Type	cit	ND	cit
Component Percent	0.4	ND	0.4
Permeability (Coresta)	36	120[4]	120 (10)
Filter Type	CA	CA	CA
RTD (mm H2O)	95	108	100
Filter Length (mm)	26.9	26.7	26.7
Weight (g)	0.17	0.17	0.17
Fiber denier	2.8	3.2	3.2
Ventilation (%)	18	22	22
Tobacco Weight (g)	0.627	0.657	0.657
Rod Density (g/cc)	0.224	0.233	0.236
ET (%)	12	None	None

[1] The presence of overtipping yields an effective butt length of 38 mm; the Winston Lights KS was smoked to 38 mm, and the calculation was done on the same basis.

[2] Calculated for Winston Lights KS.

[3] ND = not determined.

[4] Paper is perforated to 120; base paper Coresta calculated to optimize tar and puff count.

Reynolds continues to work on Premier. It is worthwhile noting that Reynolds appears to be depending heavily on vendors, and other outside sources, to develop much of their technology.

8. Strengths and Weaknesses

A list of strengths and weaknesses is shown in Table 5. RJR continues to remain strong in the areas of toxicology/biochemistry, biobehavioral science, analytical chemistry, and process development. They have expanded their efforts in optical inspection devices to cover several different types of on-line inspection. They have also devoted considerable time and effort to the area of nicotine pharmacology. As mentioned above, they are apparently discontinuing their effort in ETS; consequently, this item has been removed from the list of strengths.

RJR's R&D Center continues to remain weak in both organic and inorganic chemistry. The effort devoted to materials science that had been built up during the work on Premier has been eliminated, and many of the staff members working in this area are no longer with the company. They still depend on their vendors for the vast majority of research and development efforts involving cigarette and tipping papers. We have suspected for some time that RJR had discontinued their excellent work in the area of natural products chemistry, and that fact was confirmed this year. RJR continues to force their suppliers to adopt pricing policies which provide RJR the most favorable terms. In addition, RJR has made a number of product changes to save money. Not only have they converted the majority of their products from flax to wood pulp paper, they have also substituted sorbitol for glycerine in order to lower costs. Lastly, we have considerable evidence that morale at the Research Center is extremely low. The staff is concerned that additional lay-offs could come at any time, and there is also concern that on-going programs could be discontinued. As a matter of fact, morale throughout all of RJR is poor. There have been problems in the factories caused by employees contaminating tobacco with items such as plastics. RJR has recently adopted a policy for all visitors to their factories that no item, other than prescription eyeglasses, can be carried in their shirt pockets.

9. Conclusions

It would appear that RJR Tobacco is more vulnerable now that they have been in at least five years. It is true that they have managed to do a number of things quite well. They have been particularly astute in managing the finances of the company. RJR has been able to retire a considerable amount of high interest debt. Since June, 1990, the company has retired $9 billion of its highest coupon debt.

Table 5

RJR Tobacco R&D Strengths and Weaknesses

Strengths:

Toxicology/Biochemistry

Biobehavioral Science

Analytical Chemistry

Process Development

On-Line Inspection Devices

Nicotine Pharmacology

Weaknesses:

Organic and Inorganic Chemistry

Materials Science

Paper Technology

Natural Products Chemistry

Relationships with Suppliers

Staff Morale

RJR's debt-to-total-equity ratio now stands at 2.7:1, down from 4.4:1 at the end of 1990. They have accomplished this not only through the issue of lower interest debt including preferred stock, but also through the issue of common stock (725 million shares since 1990) which is currently paying no dividend. These moves have reduced their debt services payment from $1,554,000,000 in the first six months of 1990 to $1,142,000,000 in the first six months of 1991. In addition they have an advantage over PM with respect to their cost in producing cigarettes. A study conducted last year indicated that RJR has variable production costs $0.47/thousand less than PM USA. They remain committed to growing their tobacco business. James Johnston, CEO of RJR Tobacco, has publicly stated that RJR Tobacco's ten year goal is to pass Philip Morris in the sale of full margin cigarettes by the end of the 90's. They are clearly continuing to maintain an active Research Center; however, there is evidence that significant cutbacks will occur.

Despite these positive factors, there are considerable problems. It has already been mentioned that RJR Tobacco's sales, particularly for full margin brands, are down considerably. Therefore, the money saved through reduction of debt has had little impact due to money lost because of decreases in sales. RJR's product strategy during the past twelve months has not been particularly successful; whereas, Philip Morris's strategy would appear to be quite successful. RJR has been forced to spend considerable money in introducing a rather large number of brands both nationally and in test market. None of these introductions, at this time, appear to be winners. Although it is too early to predict how well Marlboro Medium will do, initial indications are quite promising. Although the majority of those who switch into Marlboro Medium may already be Marlboro smokers, there is reason to believe that the brand will attract a number of Reynolds smokers as well. The strategy behind the introduction of Cambridge and Bristol Lowest appears to be working. As soon as these cigarettes were introduced into Region 2, RJR started promoting Now with $2.00 coupons. This is the first time RJR has ever couponed Now, and it represents a loss of $10.00/thousand. The frequent and extensive reformulation of their current brands could pose a problem. If Reynolds smokers feel that their cigarette has changed, they may be more inclined to try other brands. Lastly, RJR is not positioned well internationally. Their direct export business has not kept pace with PM or B&W, and they are clearly not getting their share of the growing international market. RJR's world market share estimated for 1990 was only 4.9% compared with 11.0% for PM. Although they reported a 28% gain in international sales for the first six months of 1991, this figure reflects dollar sales value rather than units, and it is influenced by price increases and exchange rate fluctuations. They are also not taking advantage of any synergies which might have been expected when the International laboratory was moved to Winston-Salem. The two businesses are run completely

separately, and no attempt is made to minimize differences for brands which are marketed both domestically and internationally. Consequently, RJR is not in a position to claim that Winston is consistent throughout the world as PM has managed to do with Marlboro.

As a consequence of all of the above, it would seem reasonable to recommend that PM USA adopt an aggressive strategy vis a vis Reynolds' brands. We have already completed product development work in the area of ultra low delivery products which will force Reynolds to protect Now. We should be equally aggressive in the production and marketing of a non-filter price value brand which will force them to protect Camel non-filter. Other possibilities would be the repositioning of a full margin brand marketed so as to take share from Camel, and a third tier menthol brand positioned to take share from Salem.

B. Brown & Williamson

1. Highlights

Brown & Williamson has had a financially successful year to date, as did its parent company BAT. First quarter results for BAT showed an increase in sales of 2% compared to the first quarter of 1990, an increase in pre-tax profits of 40%, and an increase in earnings per share of 45%. Worldwide cigarette volume for BAT rose by 2%, and their share of the global market has increased to 10.3% Although BAT's CEO has warned shareholders that second quarter results may not be quite as good as the first quarter results, he also indicted that the company should do quite well for all of 1991.

Despite a good financial performance, B&W's market performance has suffered. Brown & Williamson has had the second largest decline in unit sales among domestic manufacturers for the first half of 1991. As expected, a sharp decrease in full margin sales is responsible for this decline. B&W has recently announced plans to test market a "Kool Classic" with a new advertising campaign in the near future. B&W is particularly active in direct export. Approximately 40% of the cigarettes manufactured in the US are exported. Plans are to increase their penetration into the Eastern European market.

Brown & Williamson has been more active with respect to new product introductions than they were last year. The most significant introduction involved the repositioning of Raleigh to the sub-generic category. All of the new product introductions will be discussed below.

Both BAT and B&W continue to stress lowering costs of cigarette manufacturing. In the year-end summary from BAT's CEO, Sir Patrick Sheehy, it was stated that: "Our facilities in Southampton, England, and Macon, USA, are now amongst the most modern in the world. Indeed, the cost of converting raw materials into finished cigarettes at Southampton is now 33% lower in real terms than in 1980."

2. New Products

a. New Product Introductions - Brown & Williamson has introduced the following new products domestically during the past twelve months.

(1) Raleigh Extra 100 and Raleigh Extra Lights 100 (plain and menthol) cigarettes were introduced in New York in September, 1990. Raleigh Extra 100 delivers 15 mg tar and 1 mg nicotine; Raleigh Extra Lights delivers 12 mg tar and 0.8 mg nicotine; Raleigh Extra Lights Menthol delivers 9 mg tar, 0.7 mg nicotine, and 0.2 mg smoke menthol. These products sell at a sub-generic price.

(2) Viceroy King Size and Viceroy Lights King Size cigarettes were introduced in Louisiana in January, 1991, in box packings. Viceroy King Size delivers 17 mg tar and 1.1 mg nicotine. Viceroy Lights King Size delivers 12 mg tar and 0.8 mg nicotine. These products sell at a generic price.

(3) Raleigh Extra Ultra Lights King Size and 100 cigarettes were introduced nationally in May, 1991. Both products deliver 6 mg tar and 0.4 mg nicotine. These products are being sold at sub-generic prices.

(4) Viceroy 100 and Viceroy Lights 100 were introduced into California and Hawaii in June, 1991, in box packings. Viceroy 100 delivers 17 mg tar and 1.2 mg nicotine. Viceroy Lights 100 delivers 12 mg tar and 0.9 mg nicotine. These brands are being sold at generic prices.

In addition to the product introductions listed above, Brown & Williamson has also introduced Barclay King Size Box cigarettes in Kentucky in September,1990, and Kool King Size Box and Kool Milds King Size Box cigarettes nationally in January, 1991. These 83 mm brands will probably take the place of the Long Size Box products already on the market.

b. New Brand Performance

Of the four new product introductions listed above, two involve the expansion of the Raleigh Extra family Raleigh Extra was positioned as a sub-generic in 1990, and has been doing reasonably well. In the third quarter of 1991 it held a 1% market share.

The other two Brown & Williamson test markets opened in the past twelve months involve box packings of Viceroy King Size, Viceroy Lights King Size, Viceroy 100's and Viceroy Lights 100's. Clearly the intention in this case is to increase sales of these brands by offering consumers box packings as well as soft packs.

3. Brown & Williamson Brand Performance

Although BAT's first quarter earnings showed a significant increase, B&W's sales showed a 4.1% decline during the first six months of 1991 compared to the same period in 1990. This was the second largest decrease in the industry. Most of this decline can be attributed to Kool (19.6%). B&W's price value increase has also been below the remainder of the industry (24%), but it is significantly better than Reynolds.

4. R&D Organization

There has been little change in the size of the B&W Research Center in Louisville according to published estimates. The 1991 edition of the "Directory of American Research and Technology" cites a total size for the Research Center of 215 which includes 156 professionals, 19 of whom are doctorates, and 59 technicians and auxiliaries. This number is essentially unchanged from the previous year's directory. On the other hand we were informed in early spring, 1991, that B&W had offered their R&D Department a very favorable early retirement program. Of the 30 people eligible, 18 individuals actually took the offer. Among those retiring were Lance Reynolds, Vice President Reearch Services; Jim Nall, Director of Technical Services; Phil Fischer, Manager of Blend Development; and Bob Johnson, Principal Scientist. Apparently, more people took early retirmenet than B&W had anticipated, and many of these individuals are now acting as consultants.

Perhaps as a consequence of more personnel opting for early retirement than was expected, B&W is currently hiring. There were advertisements for four positions in the August 19, 1991, issue of Chemical and Engineering News. The positions

advertised for were: 1) a Ph.D. research chemist/physicist with experience in physical testing and thermal analysis; 2) a Ph.D. research chemist with experience in gas chromatographic/mass spectrometric analyses; 3) a Ph.D. research chemist with experience in gas chromatographic/mass spectrometric methods development; and 4) a B.S. development chemist. None of these positions give any indication that B&W is becoming involved in new areas of technology. An earlier advertisement appeared in the April 8, 1991, edition of Chemical and Engineering News. The text of this ad suggested that the individual to be hired would be working in the flavor area.

The B&W Research Center is directed by J. S. Wigand, Vice President, Research and Development. Three directors report to Wigand: A. McMurtrie, Director of Product Development, and Directors of Research Services and Technical Services. Product Development is divided into six Divisions, each headed up by a manager. The six Divisions are: Blend Development, R. Wilson, Manager; Filter Development, F. K. St. Charles, Manager; Development Center, B. Bandy, Manager; Cigarette Design; International Product Development; and Packaging, K. A. Flaherty, Manager. Technical Services is divided into five Divisions, each headed by a manager, which are: Product Evaluation; Statistics, P. L. Chen, Manager; Technical Project Planning, A. J. Golub, Manager; Cigarette Intelligence; and Technical Information, A. Diesing, Manager. Lastly, Research Services is divided into three Divisions which are: Analytical Methods, J. H. Lauterbach, Manager; New Technologies, R. H. Honeycutt, Manager; and Microbiology. It should be noted that the Process Development (Engineering) Directorate is no longer in R&D in Louisville, but was moved to Macon, Georgia, about two years ago.

The full organization chart for the Brown & Williamson Research Center is included at the end of this section (Attachment 2). Also included is a complete list of all of their R&D employees, in alphabetical order, including individuals who have since left the company as well as individuals who have not yet been assigned to a specific group within the organization. It has been considerably more difficult to obtain information regarding Brown & Williamson's Research Center than it has for Reynolds. B&W is not active in publishing, nor are they as well represented at technical meetings. They are also less likely than Reynolds to issue press releases regarding, at least, R&D personnel.

5. Patents and Publications

BAT continues to patent aggressively. During the twelve month period from July 1, 1990, to June 30, 1991, the three laboratories - B&W, BAT UK, and BAT GmbH - issued 41 patents. The total included 16 US Patents, 6 European Patent Office

Publications, 10 German Patents, 8 Canadian Patents, and 1 Japanese Patent. Division by laboratory was as follows: 10 from Brown & Williamson, 12 from BAT UK, and 17 from BAT GmbH. Only four technology areas had more than two patents. BAT is still attempting to establish at least a defensive position with regard to Premier, and had a total of 8 patents claiming articles of this type. As before these patents appear to be concept patents only. There is no evidence that any of the devices claimed have actually been built, and in many cases it would appear virtually impossible to do so. BAT had a total of five patents in the tobacco processing area, three patents in the packaging engineering area, and three patents claiming varieties of a coaxial cigarette. It is not clear from the latter patents if they actually intend to attempt to market such a product. Lastly, BAT continues to be active in the area of low sidestream cigarettes. The complete list of BAT patents classified by subject matter is shown in Table 6.

Several BAT patents warrant further comment. US 4,934,524 teaches a package for storing moisture laden articles (cigarettes). This patent is virtually identical to a PM USA patent on the "humidor pack." US 4,938,235 claims a separator for separating tobacco particles from a tobacco/gas mixture. The technology disclosed in this patent could conceivably be applied to a number of current PM USA tobacco expansion processes. Further evaluation of this patent is in progress. US 4,977,908 teaches a water expanded reconstituted tobacco process using an extrusion approach which is almost identical to two PM USA patents except that the moisture levels utilized are different. PM claims a moisture level of 15-50%, while BAT claims a level of 5-15%. We are currently monitoring BAT products to determine if they are using any expanded reconstituted tobacco. US 4,986,287 claims a coaxial cigarette which is claimed to change mass burn rate without affecting static burn rate. This technology, if it is actually real, would clearly have an application to the development of a low ignition propensity cigarette. US 5,024,351 describes a device which may be used as a coupon dispenser. EP 291,104 discloses a pectin based adhesive. This technology is also being investigated further. The last two patents worth mentioning are noteworthy not because new technology is disclosed, but because very old technology has been patented. Both of these patents, EP 383,018 and JP 02-39,873, claim the use of filters containing carboxylic acids incorporated into them for the selective reduction of nicotine in smoke. More will be said regarding BAT's patent policy below.

For the past two years analysis of BAT's patents had indicated that they were pursuing a strategy primarily involving increasing efficiency in the factory and improving quality. There is little of either of these two elements present in BAT's most recent patents. It would appear that one of their chief strategies is to

Table 6
BAT Patents from July 1, 1990, to June 30, 1991

Premier Type Articles
3 B&W
5 BAT GmbH

Coaxial cigarette
1 B&W
2 BAT GmbH

Reduced Sidestream Cigarettes
3 BAT UK

Non-Burning Article
2 BAT UK

On-Line Control of Tipping Paper
1 BAT GmbH

CO2 Extraction of Alkaloids
1 BAT GmbH

Perforated Wrappers
1 B&W

On-Line Control of Ventilation
1 BAT UK

Pectin Adhesive
1 BAT GmbH

Cigarette Rolling Device
1 BAT GmbH

Tobacco Processing
3 BAT UK
2 BAT GmbH

Expanded Tobacco
1 BAT UK
1 BAT GmbH

Packaging Engineering
3 B&W

Selective Filtration
2 BAT GmbH

Packaging
1 BAT GmbH

Extruded Rod
1 BAT UK

Humidor Pack
1 B&W

Reconstituted Tobacco
1 BAT UK

QA Devices
1 BAT GmbH

Moisture Indicating Ink
1 B&W

Clock Security Device
1 B&W

establish a defensive position in areas being actively worked on by their competitors, i.e., Premier and low sidestream cigarettes. They also seem to be increasing their involvement in all aspects of tobacco processing including primary processing, reconstitution and expansion. The remainder of these patents cannot be easily categorized. BAT's technological output warrants close monitoring during the coming year.

As mentioned previously, Brown & Williamson publishes very little, although the BAT laboratory in Southampton does publish a number of papers. In the past twelve months there has only been a single publication originating from B&W. The subject of this paper, numerical predictions for a simulated methane fire, suggests that the work was done elsewhere but published after one of the authors was employed by Brown & Williamson. This appears likely in that only one of the four authors is definitely on the technical staff at B&W.

6. Technology Products

Brown & Williamson has not introduced any products utilizing new technology in the United States during the past twelve months. They continue to patent actively in a number of product areas, particularly low sidestream cigarettes and non-conventional smoking articles, but these patents appear to represent a defensive strategy as opposed to an offensive strategy.

7. Strengths and Weaknesses

Brown & Williamson's R&D Department is less than half the size of the PM USA Research Center. As such they are less able to commit resources to the development of new technology products and processes than is either PM USA or RJR Tobacco. Although the combined total tobacco related R&D resources of BAT may be equivalent to PM USA, there is probably considerable overlap in areas of expertise which prevents full utilization of their resources. BAT tends to have considerable strength in the process development and engineering areas, including the development of improved manufacturing equipment, QA inspection devices, on-line monitoring devices, and process modifications. Despite their relatively small size, they are quite opportunistic and can continue to compete with companies with greater technological resources by rapidly analyzing new technologies developed by their competitors and changing them sufficiently to give them a proprietary position.

It has been noted previously that their product patents appear to be defensive in nature. Despite this fact, their patents can provide considerable problems for PM

USA because many of them have been written in extremely broad terms which are likely to result in patent interferences with inventions we develop. For example, they now hold a large number of patents in the low sidestream area. The actual work described in these patents is not particularly novel, and in many cases it is likely that the inventions described would not work well. The claims to these patents are written in such a way to cover many variations around the invention. Brown & Williamson has indicated a willingness to be litigious in the past, and there is every reason to expect that this will continue. To have the best chance of ensuring that they cannot prevent us from practicing our own inventions, we must maintain an aggressive patent policy ourselves, and ensure that we understand those areas in which we are competing far better than they do.

8. Conclusions

B&W no longer has a dominant full margin brand. Kool, still their largest brand, has declined significantly during the last several years. Although Capri appears to be growing in 1991, its market share is only 0.5%. Both Belair and Barclay appear to be declining almost to the vanishing point. B&W has been able to increase their price value business during 1991 through a significant growth in their generics, at the expense of Liggett, and the repositioning of Raleigh Extra as a third tier brand. Market share of Raleigh Extra was 1.0% after the first six months of 1991. Nevertheless, it would appear unlikely that we would choose to compete directly with B&W because of the weakness of their full margin brands.

Brown & Williamson is continuing to build its export business. They have the highest percentage of exported cigarettes, 39%, of any of the domestic cigarette companies. This compares to 31% for Philip Morris and 19% for RJR. They are doing an excellent job in expanding this area of their business. Number of cigarettes exported grew 16.6% between 1990 and 1991. This is considerably less than PM's 22.8% growth in the same period, but is superior to RJR's 13.6%. Unlike PM, which exports the majority of its cigarettes to the Far East, B&W appears to export as many cigarettes to the Gulf Coast Countries as to the Far East.

D. JTI

1. Highlights

After several years of significant growth by the import segment in Japan, dominated by brands exported by PM USA, and characterized by numerous new product introductions from both JTI and foreign companies, this segment appears to be

plateauing. Growth of the import segment was only 0.9% during 1990 compared to 13.9% for 1989 and 12.2% for 1988. Although it would appear that some of the decline in growth of imported brands is due to the fact that their novelty may have worn out, much of the reason can be attributed to the activities of JTI itself. They remain a formidable competitor.

JTI has been extremely active in the past several years in introducing both line extensions of their successful brands as well as new brands. It would appear that this trend is also changing. JTI introduced six new packings in the past twelve months; however, only two of these were introduced in the first six months of 1991. JTI has also addressed their lack of box packers recently. They are in the process of acquiring 19 new box packers which should allow them to increase significantly their production of this popular form of packaging.

JTI is also concentrating on increasing their own exports. Export volume in 1990 was 7.2 billion units, and projected export volume for 1991 is estimated at about 8.1 billion units. Most of JTI's exported cigarettes go to East Asian countries. One East Asian country that JTI cannot export to directly is Taiwan. JTI recently licensed the Swiss cigarette manufacturer Rinsoz & Ormond to produce 1800 cases of both Mild Seven and Seven Stars cigarettes for export into Taiwan. (It should be noted that although JTI cannot export directly into Taiwan, smuggled Japanese cigarettes make up about 50% of the import market in Taiwan.) International marketing plans had called for further penetration of Middle Eastern markets, but the war in the Gulf delayed this action. JTI has also cast an eye to Eastern Europe. Exports to the United States and West European countries are hampered, according to Katsuhiro Yamasaki, general manager of international planning, "because cigarettes are a product of image, and it takes a long time to penetrate these markets with image promotions." JTI is making small-scale efforts to sell to Asian nationalities in the United States, especially in California and the New York/New Jersey areas.

JTI is continuing with its diversification program. During fiscal 1990 the firm extended its food and beverage operations, and began manufacturing and selling vending machines. Two subsidiaries were established: JT Kokubu Ltd., a food products distribution firm, and JT Nifco Co., Ltd., which is involved in industrial plastics production. Other fields of diversification are: pharmaceuticals; agribusinesses (including the Hydroponics Development Center); food and soft drink production; and real estate - particularly fitness centers, hotels, restaurants and urban redevelopment projects.

JTI has extended its involvement in the biotechnology area by entering into a worldwide joint venture agreement in June, 1991, with Cell Genesys, Inc., a privately owned US biotechnology company, through its wholly owned subsidiary, JT Immunotech USA. Under this agreement Cell Genesys will receive up to $30 million for a minority equity investment and funding support of company R&D. In addition a 50-50 joint venture will be established to develop and commercialize pharmaceutical products based on human monoclonal antibodies. Mycogen, a US biotech firm partly owned by JTI, recently announced the first EPA approval for two genetically engineered microbial pesticides. The genetically engineered products, M-One Plus and MVP, will be used to control beetles, such as the Colorado potato beetle, and caterpillar pests, including those found on a wide variety of vegetable, fruit, and ornamental crops. According to the current agreement between JTI and Mycogen, JTI will receive 25% of the revenue from these products sold in the US, 75% of the revenue from sales in Japan, and 50% derived from sales in the remainder of the world.

JTI also recently signed contracts with British Biotechnology Limited (BBL), a UK venture business, to introduce technolgies dealing with a cholesteral synthesis inhibitor in June, and TPA in December of 1990. These two genetically engineered drugs hold promise, and their annual sales are estimated to reach over $70 million each. JTI's target is to market them a decade later. Since JTI owns 10% of BBL's stake, it will be able to continue to introduce pomising drugs hereafter.

JTI is heavily involved in developing its pharmaceutical business. The company established a joint venture, Lifix, with Yoshitomi Pharmaceutical (55% owned by JTI and the remaining share owned by Yoshitomi) in April, 1988, and started marketing over the counter drugs and health-related products. Currently, JTI has four new drugs under joint development with Yoshitomi. JTI's first ethical drug will likely be marketed in 1993, if everything goes according to schedule. Moreover, the company is estimated to have several items which are awaiting clinical tests and are presently in the research stage. JTI has the marketing rights on the jointly developed drugs. Thus, the comany is preparing to set up sales channels in accordance with starting up sales of these new drugs in the future.

JTI has entered into an agreement with Egis Pharmaceuticals, the third largets Hungarian drug company. JTI is spending $10 million, half of Egis' investment, for the construction of a new pharmacology center, and will acquire exclusive rights on R&D activities, manufacturing and marketing in 42 Asian countires including Japan during the next 15 years. Whenever JTI introduces any specific technology from Egis, it has an individual licensing contract.

On the tobacco side, JT Engineering is presently constructing a primary processing plant in China. Market potential in China is, of course, huge, and JTI is interested in attempting to obtain a foothold.

2. New Product Introductions

JTI introduced the following new products in Japan during the twelve month period between July 1, 1990, and June 30, 1991.

a. Mild Seven Special Lights King Size cigarettes were introduced in July, 1990, in a box packing. This 84 mm brand delivers 10 mg tar and 0.8 mg nicotine.

b. Claris Lights King Size Menthol cigarettes were introduced in August, 1990, in a box packing. This 84 mm product delivers 8 mg tar, 0.7 mg nicotine, and 0.2 mg smoke menthol.

c. Cabin Super Mild King Size cigarettes were introduced in September, 1990, in a box packing. This 84 mm product delivers 7 mg tar and 0.6 mg nicotine.

d. Caster Bevel 100 cigarettes were introduced in September, 1990, in a box packing. This product delivers 9 mg tar and 0.8 mg nicotine.

e. Stingray King Size Soft Pack cigarettes were introduced in January, 1991. This product delivers 11 mg tar and 0.9 mg nicotine.

f. Sometime Lights King Size Menthol 20's were introduced in Japan in April, 1991, in a box packing. This 84 mm product delivers 10 mg tar, 0.7 mg nicotine, and 0.5 mg smoke menthol.

During the same period of time Philip Morris introduced four new brands, Virginia Slims Lights 100 Menthol SP, Philip Morris Lights King Size Box, Lark 100 Box, and Lark Milds King Size Box 14 Pack; Brown & Williamson introduced four new brands, Kent King Size Box, Kent Special Milds King Size Box, Lucky Strike Milds King Size Box, and Kool King Size Menthol Box; American Tobacco Company introduced two brands, American Super Lights King Size Box and American Lights King Size Box; The Liggett Group introduced Omni Blue Milds 100 SP; The London Tobacco Company introduced two brands, Hyde Park King Size Box and First Mild King Size Box; F. J. Burrus introduced Match 501 King Size Box; Rothmans introduced Dunhill Special Lights